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THE MODEL ENGINEER

The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THE FINE photograph, from which our cover has been prepared, was submitted by Mr. A. Macdiarmid, of Nottingham. It depicts the huge crane at Finnieston Quay, Glasgow, working on T.S.S. *Glenbank*, which is being fitted with new engines and boilers. Great cranes of this kind sometimes attract the attention of model makers who are seeking an interesting prototype, and the late Mr. S. J. Ward was one enthusiast who built a splendid model of a large crane—a Craven—which can be seen at the Northampton College of Technology.

Some idea of the enormous proportions of the Finnieston crane can be gathered from the picture, because there can be seen, at the foot of the crane, some locomotives built by the North British Locomotive Works and waiting to be loaded for export to South Africa, Australia and New Zealand.

A Memorial to Mr. S. J. Ward

● WE LEARN from the Northampton Society of Model Engineers that some of the equipment of the late Councillor S. J. Ward, whose death was recently reported in these columns, has been presented to the society by Mrs. Ward, who is now president. This includes a 5-in. Seneca Falls lathe and a large drilling machine, which were used in the production of Mr. Ward's superb models, some of which have been described in THE MODEL ENGINEER at various times. Several of his early models have also been given to the society, including his 1 in. scale 4-6-4 Baltic tank locomotive.

At the recent annual general meeting, Mrs. Ward presented the awards made at the recent competition night, as follows: Members' Cup, J. R. Mann; Strickland Cup, E. Hudson; Collier Cup, E. J. Szlumper; George Shaw Cup, H. J. Hawker; Bassett-Lowke Cup, W. A. Wells. A further award of one guinea was made to the winner of the "Bits and Pieces" competition, J. R. Mann. Mrs. Ward later announced that she was presenting the society with a silver cup, to be known as the S. J. Ward Memorial Cup.

Index for Volume 106

● WE REGRET that, once again, we were not able to provide a bound-in index for the volume (106) which was completed with the June 26th issue, but we will send a copy to any reader who makes a special application for it.

We would be obliged, therefore, if every reader who really requires a copy will advise us immediately, enclosing an envelope large enough to take the "M.E." flat, stamped with a *three-halfpenny* stamp and addressed to himself. His copy of the index will be forwarded to him as soon as it is available.

The West Midlands Federation Rally

● THIS ANNUAL event, held recently at Campbell Green, Sheldon, Birmingham, was again a great success, despite the inclemency of the weather, which vainly did its worst to damp enthusiasm. Traffic on the continuous track ran to full capacity, and never less than two locomotives were in action at any time until well into the evening. Several interesting new locomotives had their first trials on a track, including Mr. J. D. Curtis's 3½-in. gauge free-lance 2-6-4 tank (Birmingham S.M.E.) and Mr. Castle's 5-in. gauge 0-8-0 tank, with Baker gear (Worcester S.M.E.), both of which performed exceedingly well. A further development this year was a display of control-line flying by two members of the Redditch M.E.S. The Birmingham Group of the International Radio Controlled Models Society also gave a very interesting demonstration, but their land models were handicapped by the wet weather, and their ship models by the lack of a suitable pool. There were 11 entries in the competition for the Federation Challenge Cup for the best model of the year, and the judges, Lt.-Cdr. Craine and Mr. Thompson, found it no easy task to pick out the winners. First place was awarded to Mr. F. A. A. Parisier's brig *Procrius* (96 points), second place to Mr. J. K. Strickland's 5-in. gauge 0-6-0 *ex*-U.S.A., W.D. locomotive (94 points), and a tie for third place was made by Mr. S. J. Applewhite's 2¼-in. scale Peckett saddle tank locomotive and Mr. A. T. Judd's free-lance steam coaster, *Eletheria* (91 points each).

Road Locomotives at Chester

● DURING THE week May 5th to 10th, there was a fair at Chester, on a piece of ground bounded by Grosvenor Road, Castle Drive and the River Dee. Mr. W. G. Powell, of Buckley, was advised by a friend that "a proper posh puffer and two dirty old puffers" were to be seen there; so Mr. Powell went to investigate and, since he is keenly interested in road locomotives, he found a sight that gladdened his heart.

The "proper posh puffer" proved to be a Burrell, No. 2788, named *The Griffin*, in really lovely condition. She was in steam but not actually working when Mr. Powell visited her.

Of the "dirty old puffers," one was Burrell No. 3865, without a name, but with "No. 1" in the place where the name is usually to be found. This was a bigger engine than No. 2788 and was driving and lighting a waltzes ride and a set of Galloping Horses; she was equipped with a crane.

The other "d.o.p." was a McLaren named *Goliath*, driving and lighting a set of bumping-cars.

Both these engines certainly merited the description which Mr. Powell's friend had applied to them; but it is more than satisfactory to know that they are to be repainted before midsummer; in fact, this has already been started in the case of the McLaren.

Mr. Powell adds that the Galloping Horses were a fine sight, especially as the accompanying music was being supplied by the old-fashioned organ (electrically driven). The absence of the centre-engine was not *so* much regretted when one remembered that the ride was being driven by the Burrel hidden far behind the stalls.

Exhibition at Chelmsford

● FROM JUNE 4th to 7th, the Drill Hall at Chelmsford was the scene of another very comprehensive and attractive exhibition organised by the Chelmsford Society of Model Engineers. Locomotives, ships and boats, traction engines, aircraft, workshop equipment, model railways, clocks and scientific apparatus were all fully represented. The general standard of excellence was high and there was something to interest every model engineering enthusiast.

In view of the recent discussion on electronic organs, readers may be interested to learn that, at this exhibition, one of the outstanding exhibits was an electronic organ built by two local brothers, J. J. and C. C. Clarke. J.J. gave frequent "recitals" on this instrument and proved that it was a thoroughly satisfactory piece of work. It is equipped with Swell and Great manuals, on each of which there are eight speaking stops, and there is also a 20-note pedal board. The tone of each stop is excellent and is produced entirely electronically. The apparatus is, admittedly, complicated, but it is not very "difficult" or bulky; the whole instrument is little, if any bigger than an ordinary double-manual harmonium. The sound is equal to that of a pipe-organ; after all, each note can be tuned to almost any degree of purity, according to the skill and requirements of the builder. For example, the tones of the flute and the trumpet can be reproduced by varying the intensity and harmonics of the fundamental notes. We hope to be able to publish a technical description of this very interesting instrument in the not-too-far-distant future.

"Super Lions"

● OUR RECENT references to the Fowler showman's engine *Supreme* seem to have attracted quite a lot of attention. Several readers have asked if we would give a list of the four engines which made up what we described as "that magnificent quartet." We were about to send out an enquiry to one or two of our "traction engine" experts when a letter arrived from Mr. J. A. Smith, of the Spenborough Society of Model and Experimental Engineers, who mentioned all four of these engines; he writes:

"*Supreme* was not a 'Big Lion,' but a B6 type 'Super Lion.' Four of these engines were turned out; they were: No. 19782, *The Lion*, March, 1932, for Anderton & Rowland; No. 19783, *King Carnival*, April, 1932, for F. McConville; No. 19989, *Onward*, April, 1933, for S. N. Ingham, and No. 20223, *Supreme*, March, 1934, for Mrs. A. Deakin. These were the first engines by Fowlers with left-hand steering."

We are grateful to Mr. Smith, for his letter saved us a little time. We know where the *Supreme* is now, but we wonder if any of the other three is still in existence. Probably not, unless it is rusting away in some scrap-yard.

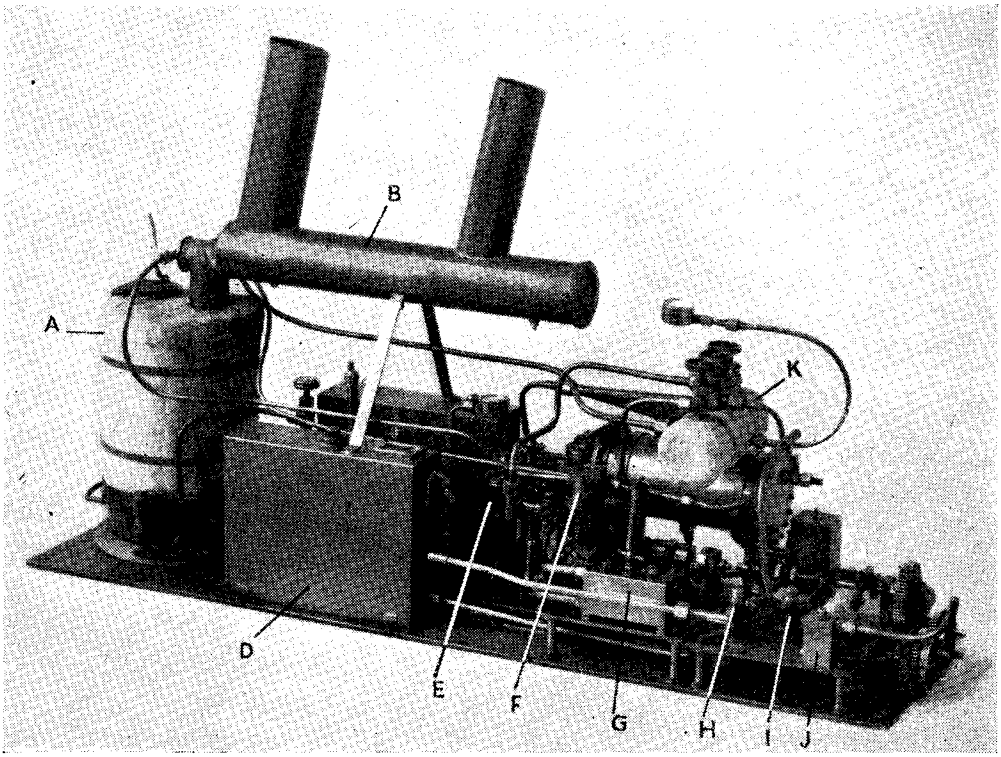
A Model Steam Plant
for a Coal-Fired Steamer
by Victor B. Harrison

I HAD given up the idea of constructing any more model steamers. My research in that branch of model engineering is known to many readers, and the claims that I succeeded in establishing were two; one was that I constructed a glass-case model which could be run with a steam-plant without damage to its appearance, and the other was that I could do everything with methylated spirit that others felt could only be done with paraffin or petrol firing.

The late Mr. Percival Marshall gave me full marks as regards my methods, and told me that unless he had seen my models, in action, he would not have credited it possible. After such a compliment, I had to go out and buy a new hat, as the old one no longer fitted.

I think it was in 1940 I went to Messrs. Bond's to see if I could get some material which, in those days, was a pretty hopeless quest. I saw on the counter a large collection of Messrs. Whitney's model engines. Mr. Phillips was there, and I asked him where on earth he had got hold of them. He informed me that the models were what was salved when that firm's premises were blitzed, and he had bought them.

They were a most interesting collection. I then and there bought three of them. One of them was a model compound engine with the cylinders side by side arranged for driving a twin-screw boat, and although I really did not want it, I bought it just because it intrigued me.



A—Boiler; B—Smoke manifold; D—Water tanks for feeding pressure tank; E—Main compound engine; F—S.T. engine driving circulating pump; G—Three-throw circulating water pumps; H—Pressure tank feed pump; I—Bilge pump; J—Wet and dry pump; K—Steam drum

That was the beginning of my fall, although I did not realise it at the time. The steamer "bug" had entered into my soul once again!

The lack of materials during the war made things very difficult, and yet I was eager to do something. I often looked at the little engine, and even ran her under compressed air. The "bug" was at work, as I began to realise that a compound engine requires a condenser, and a

condenser requires a water circulating pump. In our works, we have several three-throw boiler feed pumps, and looking at them, I decided to have a shot at making one.

Fishing about in my scrap-box, I found a piece of brass measuring 2 in. × $\frac{5}{8}$ in. × 1 in., also some suitable brass rod for pump barrels, and some very old German silver rod for plungers. The pump was constructed, and mounted on a base. An old S.T. Henley boat engine was also unearthed to drive it. I decided that the little engine would not be very powerful, and must be geared down. I decided to do that with a four-to-one skew gear. In Bond's pre-war catalogue was the very thing, so I went there hopefully, and asked for it. I was met with smiles and regrets—they had not got anything at all. While the conversation went on, an assistant offered to have a look in a drawer of mixed junk. The miracle occurred! They found both spur and gear-wheel.

At last, the pump and engine were all fitted up on a brass base. The last thing needed was a displacement lubricator for the engine. I coupled the engine up to my steam raising boiler for my locomotives, and then I turned on the steam. It worked the very first time. I connected the pump up to a tank with rubber tube, and hoped for the best. All I can say is that the pump worked, but not with the steady stream of water that I had hoped for. I then dismantled the pump and made sure all the ball valves were properly seated. At the next trial, there was a vast improvement, but still it was not a steady stream of water as it theoretically should have been. Anyway, I passed it as O.K.

Having constructed the circulating water pump, I decided that the next thing to tackle was a condenser. In my junk box, I found an odd piece of copper tube, the remains of one of my locomotive-boilers. At the works, I found some brass rings out of which I made the flanged ends. Out of some sheet brass, I made the ends which were finally bolted on to the flanges.

Then the search began for $\frac{1}{16}$ in. × $\frac{1}{4}$ in. bolts and nuts. This time, I met by Waterloo! I tried for weeks, but no one or place could help me. I had by me a suitable piece of brass hexagon rod. Well, there was only one thing to be done—and that was to make them out of the piece of brass rod. Anyway it was something to do to keep my mind off the blitzes and the war. I made 45 of those nuts and bolts.

Now for the innards of the condenser. I had only a very hazy idea how they were constructed. I was not certain as to whether the steam passed through the internal tubes, or whether the water did. I hunted all through my MODEL ENGINEERS from No. 1, but not a line did I find. A friend of mine asked me quite by chance, if I was doing any model work. To cut a long story short, I told him I wanted to find out how a condenser was constructed. He sent me a fine volume of marine engineering which had belonged to his father, and in the covering letter, said he thought I should find in it what I wanted. It was a most interesting volume, entitled *A Manual of Marine Engineering*, by A. E. Seaton, published by Charles Griffen & Co. Ltd.

That gave me the information I wanted. The water went through the tubes. The interesting part to me was that the water went into the bottom of the condenser, and first of all went through the lower half of the tubes. The other end of the condenser was like the combustion chamber of a return-tube boiler. From there, the water went through the upper tubes, and then left the condenser. That meant that one end of the condenser had to have a division plate so that the water only entered the lower tubes, and the exit had to be constructed in the upper half.

The next item required was some $\frac{1}{8}$ in. thin-walled copper or brass tube. Off I went hopefully to Smith's of Clerkenwell. I knew one of their foremen, but he was not very hopeful. He told me that they had no kind of $\frac{1}{8}$-in. tube delivered since the outbreak of hostilities. Nevertheless, we went down into their catacombs, and by mere chance, on the floor I saw a long piece of rather buckled and bent tube. Would you believe it? It was just what I wanted. The foreman banged it about on the floor and got it reasonably straight, and then cut it up into three-foot lengths for me to take home. Anyway, after much patience and labour, I got the sixty $3\frac{3}{4}$ in. long tubes out of it dead straight.

In the article on condensers, it was stressed that the exhaust steam must just breathe on the tubes, and not enter the condenser as a jet. I saw the point of that, but how to construct that breather was the problem. The finished article can be seen in the illustration. It gave me much food for thought.

In my mind, there was only one way of doing it, and it was this! I asked the works foundry to cast me a piece of lead 6 in. square and $\frac{1}{4}$ in. thick. Out of that, I cut and filed a solid breather which I took to the electro-depositing department, and asked the foreman to cover it with a copper covering about $\frac{1}{16}$ in. thick.

When I got this, I filed and cleaned it up, and finally polished the outer covering. I then filed off both ends, exposing the lead. I took it to the type foundry, and threw it into the melting pot. In due course, the lead melted out, and there was my breather all in one piece. It only remained for me to fit a flange on the large end, and a steam union on the other. I must confess I felt very proud of my condenser! So far so good. I had had many months of interesting work and I had gained a lot of fresh knowledge. All the bits and pieces were put away in a drawer, and might have been forgotten.

One week-end, when the late "Uncle Jim" came to stay with me, and we were discussing models in general, I showed him this funny little Whitney Compound. He was most intrigued. I then showed him the pump plant and my condenser. He asked me what I was going to do with it, and I confessed that perhaps one day I would rig it all up, and run it with some sort of boiler.

He suddenly said to me, "Why not make a coal-fired boiler for it, and fix it in a boat?" Before I could tell him I considered that out of the question, he suggested that I should build a boiler similar to the one Mr. Rogers had constructed for his Sentinel locomotive. "You can fire it from the deck through the top," he said,

"and if that boiler works his locomotive, it will drive your plant. You go ahead, old man, and once again you will have produced something out of the ordinary."

I straight away looked up the description of Mr. Rogers's engine, and came to the conclusion that "Uncle Jim's" suggestion was feasible.

To get hold of some $\frac{3}{16}$-in. stainless tube for the boiler was out of the question, especially as the war was still on.

This scheme so took hold of me, that once again I got the bits and pieces out, and schemed out the shape the whole plant should take. I had by me a nice piece of sheet brass $\frac{1}{8}$ in. thick. I took it to the works, and they cut out a piece measuring $22\frac{1}{4}$ in. long by $6\frac{1}{2}$ in. wide. This was to be the base on which the whole plant should be mounted. I then enjoyed myself planning how the bits and pieces should be mounted, which included the water and air pressure tank; and also the water tanks.

I was again lucky in picking up a piece of copper tube to make the air/water pressure tank, which measures $2\frac{3}{4}$ in. $\times$ 5 in. The ends were made by brazing in $\frac{1}{16}$ in. copper sheet with a stay through the middle. The two watertanks were made of copper sheet, which I scrounged at the works, and measure 5 in. $\times$ $1\frac{1}{2}$ in. $\times$ 4 in. These are mounted on each side of the pressure tank.

I next mounted the compound engine on the foundation, extended the shafts to the end of the baseplate, and re-fixed the geared flywheels. I then mounted the circulating pump and engine on the baseplate, and also the condenser, then coupled up the water pipes. The pressure tank and the watertank were then placed in position, and this left just nice room for the Rogers' boiler to be mounted.

Pumps

The next problem was not so very easy. The condenser required a wet and dry pump, also the water from the tanks had to be conveyed to the pressure tank. In my junk box, I found two very old Bassett-Lowke water pumps. One would do duty as a water feed pump for the pressure tank, and the other as a bilge-pump. I constructed a wet and dry pump, $\frac{3}{8}$ in. bore, $\frac{1}{2}$ in. stroke, with ball valves. All three were mounted on a baseplate, like the three-throw pump, and were driven by a three-throw crankshaft geared down 4-to-1 off one of the driving shafts of the main engine.

I thought it would be advisable to use a mechanical lubricator for the main engine, and I constructed one. That was also driven off the geared 4-to-1 shaft. I wrote to "L.B.S.C." about my troubles with the ratchet wheel, and he very kindly sent me two with his compliments. I tried the main engines with my little boiler, and all worked well. The lubricator did its job. The engines had to exhaust into the atmosphere, as naturally the rest of the plant was not working.

I had constructed the steam reception drum with valves for the circulating pump engine, main engine and steam-blower and union for steam from the boiler, and Messrs. Bond's brazed it all up. Messrs. Bond's tried for seven years to get me that length of stainless $\frac{3}{16}$-in. diameter tube for the boiler. I finally gave up the idea of ever completing the plant. Then one day they rang me up and asked me if I still wanted the tube. I told them to get it at once! I was then informed of its arrival, took up the plant, and said "get on with the good work."

Did they smile at my plant? I must confess that the late Mr. Heath-Robinson would have given me full marks, but Mr. Layton, of Messrs. Bond's, said "Although it looks funny, everything is there for a really true marine compound-engine plant."

At long last, the boiler was completed, and all connected up. But also, the real troubles then started. Mr. Layton informed me that the boiler seemed to steam well, but it did not seem to be able to steam both engines.

A Test

I went up one afternoon, and we had a test. Very definitely something was wrong with the circulating pump plant. That did not run at all properly. The oscillating cylinder kept coming off its face. We decided that we would cut it out. Even the main engines did not seem to have any life, although we had about 60 lb. of steam. I suddenly realised that as there was no cooling water going through the condenser, its exhaust was being choked. We disconnected the condenser, and then, of course, it was quite a different story. We kept the boiler going with induced draught from the air compressor. I was delighted. The boiler was doing its stuff. Mr. Layton thought that my pressure tank feed was not quite the thing, but he was very mistaken. When the test was finished, I noticed that the ends of the pressure tank were bulged. What had happened was that the pump had quietly been doing its stuff, had filled the pressure tank right up, and was doing a hydraulic test on its own. Anyway, in spite of Mr. Layton's surprise, he soon put the ends right again.

I took the plant home, and the first thing I did was to remove the circulating water plant. I soon diagnosed that the trouble was a bent crankshaft on the pumps. It was a hopeless thing to try to put right, so I finally decided to make a new one, and this time did not rely on just pinning the webs, etc., but to braze it all up. This my son kindly did for me.

When we tried it with my other little boiler, the engine purred like a pussy cat, and also I noticed that the pump was delivering a much steadier stream of water.

There is one thing I have forgotten to mention—the steam drum. Mr. Layton, on his first test, told me that as we could not put this drum close to the boiler due to interfering with other parts of the plant, he had put it in a good position—14 in. away. The result was that the engines were getting very wet steam. I asked him to lag it, which he did, and now one gets steam at a reasonable temperature.

The next thing was to make a circulating water tank out of an old tin, for cooling water for the condenser. I connected it up with rubber tubing, and all was ready for what I thought was the grand finale. I was never more mistaken in my life! The troubles were only just beginning.

(To be continued)

A Carburettor for the "Busy Bee"

by Edgar T. Westbury

AT the conclusion of the articles on the "Busy Bee" 50 c.c. auxiliary engine, I informed readers that a special carburettor and magneto for this engine were in course of development, and would be described in due course. Since then, I have had many reminders of this promise from readers, and now that the engine has had time to become fully established as a practical proposition, both in respect of its facility for construction in the home workshop, and its successful performance when completed, I feel that the time is right to follow it up with the accessories referred to. In the opinion of some readers, the engine design is indeed incomplete without them, and I am in agreement with them to a certain degree, but the use of accessory components already available ready-made was recommended as a temporary measure, first of all to save time in the development of the engine design as such, and secondly, to reduce the amount of work which must necessarily be undertaken by constructors, some of whom might have considered the work involved in the accessories more difficult and tedious than that in the engine itself.

Almost a Swarm!

Incidentally, it may be mentioned that there are now quite a number of "Busy Bees" performing quite successfully on the road—to say nothing of those which have been or are being adapted to other purposes, including lawn mowers and even outboard marine motors. I have just heard of one which has been successfully employed as the power unit of a passenger-hauling locomotive—a fact which will probably horrify the "live steam" fraternity, but I understand that the constructor is quite regardless of the enormity of his crime, and is feeling very pleased with the results obtained. There have been a few instances where constructors have run into difficulties or failed to get the performance expected, but this has usually been due to some cause which was easily detectable, and mostly capable of correction, except where some major deviation from the design has been made. One constructor was rather disappointed, because I could not guarantee that the "Busy Bee" would provide adequate power for a tandem *plus* a sidecar for baby! (There ought to be a Society for the Prevention of Cruelty to Small Engines!)

To revert to the subject of our present discourse, a good deal of experimental work has been done on both the carburettor and the magneto, and both have given excellent results; what is more important, their constructional design has been arranged so that they will present no formidable difficulties to anyone capable of building the engine itself. So far as the carburettor is concerned, the supply of material for construction involves no serious problems, but in the case of the magneto, there is at present difficulty in the supply of suitable magnets, and the success of this item, from the constructor's point of view, will depend on whether the deficiency can be surmounted.

Carburettor Design

As readers are probably aware, I have designed quite a number of carburettors for small engines in the past, most of which have been described in THE MODEL ENGINEER, and detailed prints for their construction are available. I have often observed that any carburettor which gives really good results on a small engine will work at least as well on a larger one, and therefore any of these designs can be adapted to work on the "Busy Bee" engine. But the present design is of the type which may be considered "orthodox" for such engines, as it follows the established practice for motor-cycle carburettors, and employs the standard method of control by Bowden cable. It is not a copy, or even a near-copy, of any existing commercially-made carburettor, but does not involve any original principles of operation (indeed, it would be difficult to find any) and such differences of detail which it incorporates are intended mainly to simplify home construction and make it adaptable to any engines of the approximate size specified.

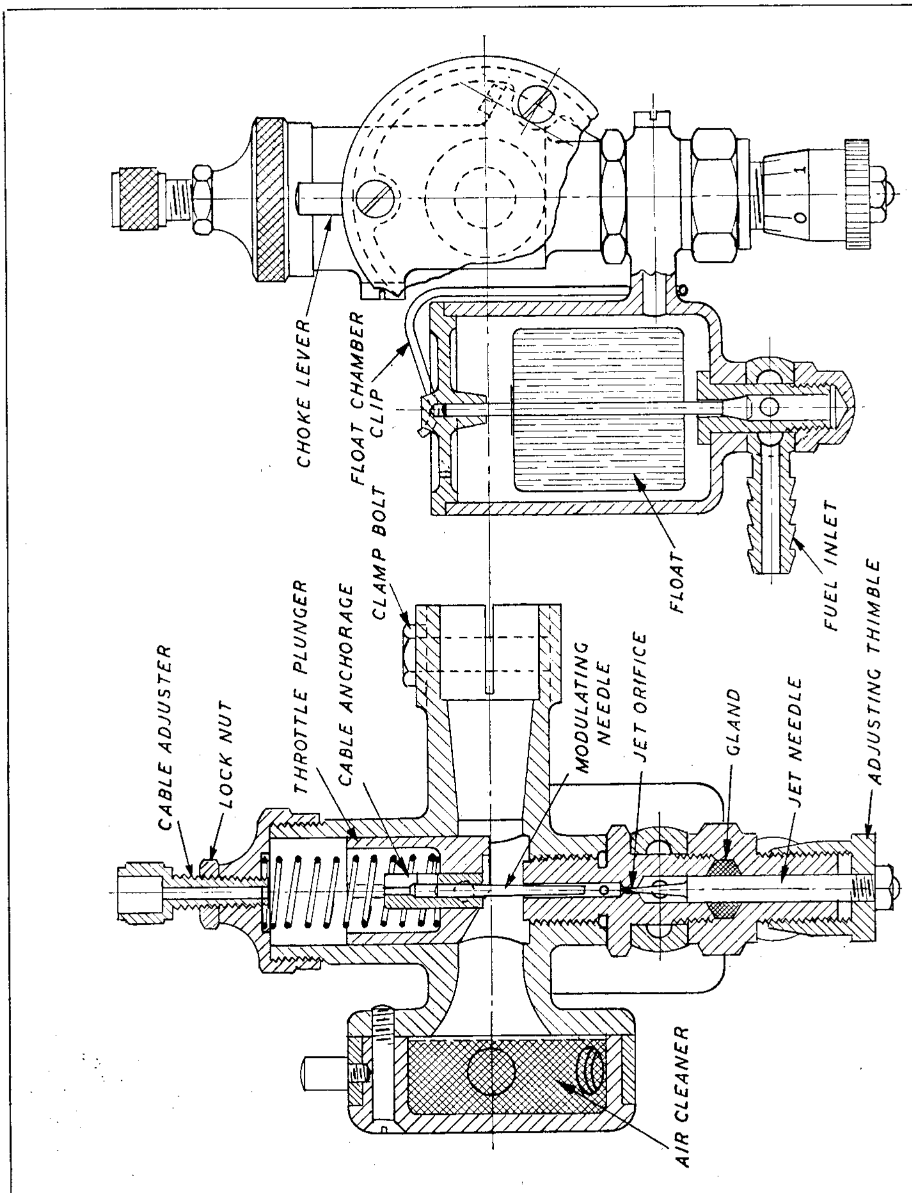
As will be seen from the drawings, the carburettor is of the straight-through horizontal type, with a vertical plunger throttle; and here it may be mentioned that although a few degrees deviation from this position is permissible, any drastic alteration in this respect would require redesign of the jet and fuel feed system. A normal float feed is employed, with a direct-acting float-valve, and the float chamber is connected to the body by a swivel union or "banjo" so that it can be set on either side, or swung through a limited angle, to suit convenience of installation; the fuel inlet to the float chamber is similarly arranged. The actual metering orifice to the jet is submerged, and is, under normal working conditions, constant after being adjusted to the conditions of running; in other words, "pre-set," but it may be made as a fixed calibrated orifice if preferred. The throttle plunger is cut away at an angle on the intake side to modify the depression in the region of the jet, and also has a modulating needle attached, which moves in the upper part of the jet tube, and influences the depression at the actual jet orifice.

A simple form of air cleaner is fitted to the air intake, incorporating a shutter or choke which is used only to assist starting from cold—it is definitely not intended as a running control.

The filter medium is a pad of steel wool, which is kept damped with oil, and is held in position by a disc of coarse gauze.

Compensation

In common with most carburettors in this class, the compensation is mainly mechanical, the richness of mixture being influenced by the shape of the throttle plunger and the capillary annulus around the modulating needle. If the end of the plunger were cut off dead square, the mixture would tend to become weaker as the throttle was opened, due to the decrease in the air velocity over the mouth of the jet tube. On the other hand, if the plunger were made with no controlling edge on the intake side at all, the reverse would apply, as the velocity over the jet tube would decrease as the throttle was closed. Generally speaking, the shaping of the cutaway on the intake side of the throttle affects most strongly the acceleration range, but if relied upon entirely, tends to lose its influence

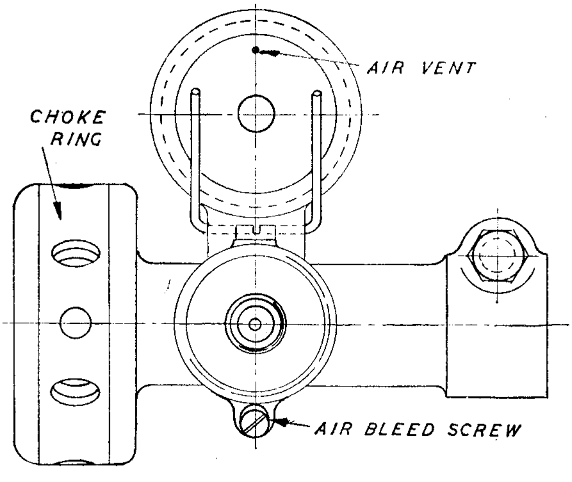


Side and end elevations of "Busy Bee" carburettor

at the wider throttle openings, and, therefore, the modern tendency is to supplement it with a needle which works either directly in the jet orifice, or in a diffuser tube above the jet.

A very serious objection to attempting direct control of the jet orifice by a moving needle is that it is violent or critical; also, that very slight wear of the needle would make an enormous proportional difference in the area of the orifice. In a small carburettor, the needle would have to be so fine, and its contour so exact, that it would be very easily deranged. But a further disadvantage is that it makes the compensation entirely dependent on mechanical moving parts, and loses the most important virtue of the submerged jet.

The use of a larger and more robust needle in the extension of the jet tube gives considerably more latitude in adjustment; the taper is more readily measured and, if necessary, corrected, while the effect of any wear which may take place is less in proportion to the area of the controlled annulus. In some cases, it is found practicable to use a needle with no taper at all, its effect being obtained by varying the length of the capillary annulus around the needle, and consequent variation of jet friction.



Plan view of carburettor

"Air Bleed"

Further control of compensation, in this case independent of the position of the moving parts, can also be obtained by means of an "air bleed" to the jet tube. This consists of a device for admitting a small and controlled amount of air just above the metering orifice, in such a way that it reduces the depression in the jet tube, and thereby influences the amount of fuel discharged. It thereby rectifies the most serious limitation of the mechanically-compensated carburettor, namely its inability to allow for any changes of speed apart from those due to throttle control. For instance, a cycle running under power on a level road will obviously attain a higher speed than when climbing a hill, for a given throttle opening (it is assumed that the gear ratio is unchanged). With mechanical compensation, this would result in weakening of the mixture under the increased load, an obviously undesirable feature; but with the provision of the air bleed, the reduction in engine speed results in less air being drawn into the diffuser tube, and as the jet is submerged, it tends to be fed at a constant rate by gravity, so that the strength of the mixture is kept up, or can even be increased if this is considered desirable. Yet another advantage of the air bleed is that the small amount of air drawn over the jet orifice assists atomisation, and tends to promote efficient combustion and fuel economy.

The use of an air bleed in some form or other, or at least an equivalent load-compensation device is practically universal in modern automobile carburettors, but not always with full effect in motor-cycle carburettors. I have used it effectively in many of the devices I have described in the past, including the "Atom" and "Apex" carburettors, so I have no doubts as to its virtues in the present case.

The Variable Jet

Opinions are widely divided as to the merits of this device, which is often a great temptation to meddling fingers, and for this reason, has long been discarded by nearly all commercial carburettor manufacturers. But I think that all intelligent users of engines will agree that sizes of fixed jets are very difficult to assess properly, even in engines which are apparently all made to the same specification, and that some means of adjusting the jet orifice is often desirable. Model engineers are, as I hope and believe, sufficiently intelligent to know how to use such an adjustment with discretion; most of them have experience with tiny engines in which the only "control" worth mentioning is the jet needle. In any case, however, the variable jet specified for this carburettor is purely an optional feature, and a fixed jet may be fitted if preferred, or the arrangement modified so that the jet needle can be completely enclosed and sealed off from possible risk of interference when once adjusted.

A Useful Device

Alternatively, it may be mentioned that it is possible to fit a variable jet similar to this on existing carburettors, and in the development of the "Busy Bee" engine I found such a device extremely useful. During the running-in period, it is nearly always found that an engine calls for a comparatively large jet, particularly if oil is used liberally (as it should be), and when the engine has settled down and is running freely, the jet size can be considerably reduced. Any experiments with different oil-fuel ratios, or different makes of oil, will, however, call for slight readjustment of the jet, and so will varying climatic conditions, if the optimum performance is to be obtained from the engine.

Personally, I would not on any account be without some means of altering the jet adjustment without recourse to the use of tools and fitting of spares. This may be because I belong to an older generation of motor cyclists who were brought up on the good old "two-lever" carburettor, on which the mixture had to be adjusted to suit loads and speeds as one went along. Despite the disadvantages of this primitive device, which apart from its inconvenience, might well become a menace in modern traffic conditions, when one's full attention must be concentrated on driving, it did at least teach us the vital importance of having the mixture exactly right for the running conditions.

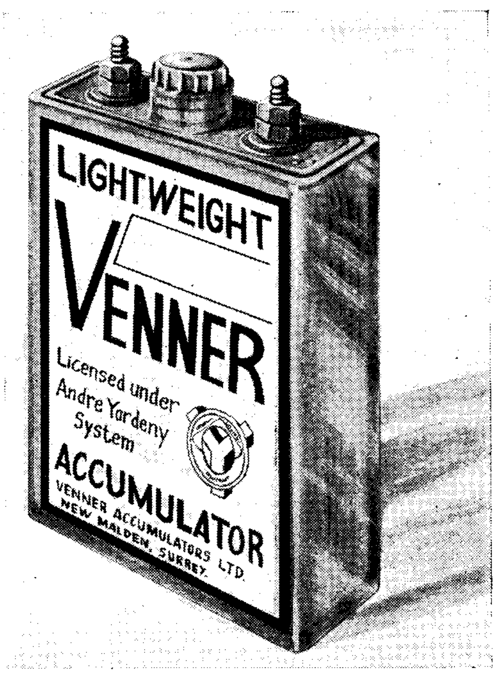
I have made the jet adjustment thimble similar to that of a micrometer, so that it is possible to provide easily legible graduations and figures; the divisions are, of course, purely arbitrary, but they provide a means of showing how much the jet orifice is opened and enable the adjustment to be returned to *status quo* after alteration, if need be. As the jet needle is below the fuel orifice, a packing gland must be provided to prevent leakage; this is of a simple type with no means of adjustment, as the amount of needle movement is so small that wear of packing is negligible.

(To be continued)

Venner Lightweight Alkaline Accumulators

SOME three or four years ago, a new type of alkaline storage battery was introduced by Messrs. Venner Accumulators Ltd., Kingston By-pass, New Malden, Surrey. These are of the silver-zinc couple type, using an alkaline electrolyte, as first developed in France by M. Henri André, and their special feature is their high capacity in relation to bulk and weight, which is achieved without sacrifice of durability or other desirable practical features. This renders them particularly well suited to many purposes within the sphere of model engineering, where space and weight are invariably restricted.

These accumulators are made in a wide variety of sizes and types, from 12 V, 40 A.h., weighing 13 lb. 2 oz. down to 1.5 V, 0.5 A.h., weighing $\frac{5}{8}$ oz. The voltage per cell is in all cases 1.5 under normal discharge, and a notable feature is the constancy of voltage maintained throughout the discharge period. The cells are capable of being charged and discharged over a number of cycles comparable with, or even in excess of, that of the best types of lead-acid accumulators, and exceptionally high rates of discharge are possible without damage to the active elements.



We have conducted a long and very thorough series of tests with Venner accumulators, including the Type M (1.5 V, 5 A.h.) which measures $2\frac{5}{16}$ in. high, $2\frac{1}{16}$ in. wide and $\frac{13}{16}$ in. thick, weighing 4 oz., and the Type D (1.5 V, 1 A.h.), which measures 2 in. high, $1\frac{1}{8}$ in. wide and $\frac{5}{8}$ in. thick, weighing 1 oz. These cells have behaved well, and have shown no signs of deterioration either in use, or when laid by for considerable periods without attention. Two of the Type D cells have given very good results in providing current for the ignition of a small petrol engine, which is usually regarded as one of the most arduous duties for a small battery. Charging can be carried out with an ordinary trickle charger, preferably at from ten to twenty hours rate, but if necessary much higher charging rates are possible with suitable voltage control. The cells are fully charged when the voltage reaches 2.1, but on discharge this drops rapidly to 1.5, continuing at this level until almost completely discharged.

It should be remembered that these cells, in common with all alkaline types, are allergic to acid, and only the pure electrolyte supplied by the makers should be used, evaporation losses being made up by the addition of distilled water to a level slightly below the top of the plates.

An attractive illustrated brochure describing the full range of these accumulators, with examples of discharge curves and other data, has recently been issued, and can be obtained from the manufacturers.

A Simple Photographic Rangefinder

by R. F. Stock

ONE of the most useful photographic accessories is the rangefinder, particularly when it is built into the camera and coupled to the focussing mechanism.

Only expensive commercial cameras are so fitted, and this is due partly to the accuracy of manufacture and adjustment required ; neither of these factors is a deterrent to amateur construction, so the instrument is well worth while making by the model engineer. This is particulary true since in our hobby one frequently has occasion to photograph one's own (or a friend's) models in action, and this type of subject is one where accurate focussing is essential.

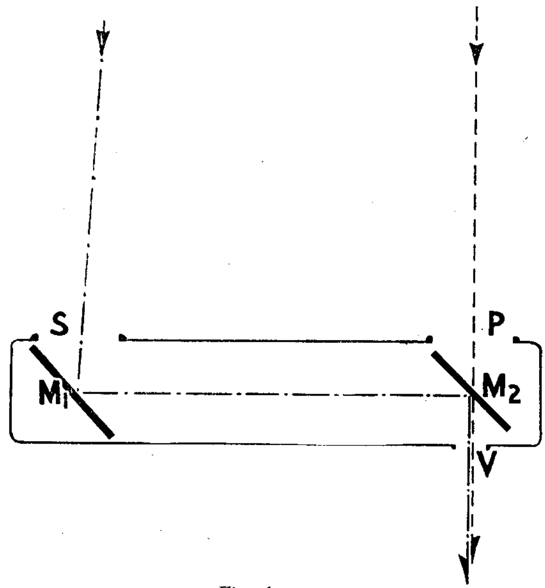


Fig. 1

Commercially made rangefinders are produced either as separate instruments with an adjusting knob calibrated in distance, or as an integral part of the camera, when the adjustment is made by rotating the focussing knob. In both cases the principle is similar, and such instruments commonly utilise a lens and prism system ; this is less suited to amateur construction and some experiments were recently conducted to determine whether a really efficient rangefinder could be made, suitable for coupling to a focussing camera, without using any complicated optical system or components not normally available.

The rangefinder described in this article is the successful result of these tests.

Principle

Fig. 1 shows a simple rangefinder. The base is provided with a primary and a secondary aperture (**P** and **S**) and a viewing aperture (**V**) opposite **P.**

An eye placed behind **V** sees, through **V** and **P** a direct view of the object whose range is to be taken. At the same time an image of the object, reflected by mirrors **M1** and **M2**, is seen through **S.** Provided that the two mirrors are adjusted to the correct angles the image of the object and the object itself will be in coincidence, i.e. only one image will be apparent. **M2** must of course have the peculiar property of reflecting the light from **M1**, while being transparent to rays passing through **P.**

In Fig. 1 the pecked and chain-dotted lines

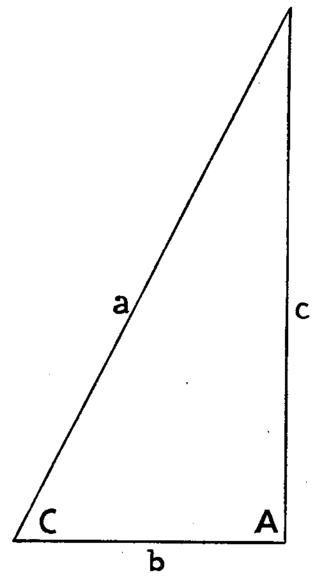


Fig. 2

represent the axes of the bundles of rays forming the two views of the object, and they are shown diverging from some point at a distance. The actual angle between them will of course vary from zero degrees (when the point is at " infinity") to a few degrees when the object is near. This change of angle is an index of the range of the object, and the adjustment required at one of the mirrors in order to present the images in coincidence can be used to determine the distance of an object.

The geometrical basis of the principle is noted in Fig. 2. The base of the triangle **b** is the distance between centres of **M1** and **M2** (or **P** and **S**). Angle **A** is a right angle while the other angle at the base (**C**) can be measured.

Since $\tan C = \frac{c}{b}\left(\text{i.e. } \frac{range}{base}\right)$

and since the base is known and fixed, measurement of angle **C** enables us to calculate the range.

In practice, no calculations are required since the instrument is calibrated experimentally: it is, however, useful to work out the value of angle **C** for various distances. Assuming a base of 2 in., the following values of **C** are found at the ranges shown:

Infinity—0°, 10 ft.—1°, 5 ft.—2°, 3 ft. 3 in.—3°.

These results are only rough, but serve to indicate that the angular change is small and must obviously be measured fairly precisely if accurate ranges are required.

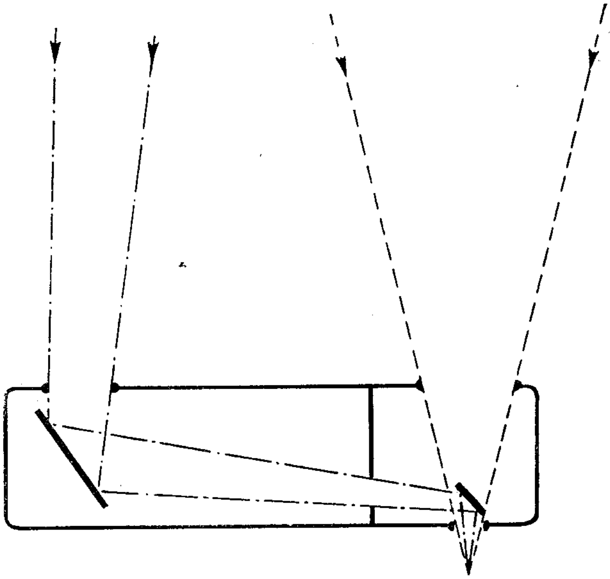


Fig. 3

Design

Commercial rangefinders often incorporate lens systems, but these affect only the clarity, size or demarcation of the field of view and in no way alter the principle described above.

All rangefinders, therefore, follow the pattern of Fig. 1, the main differences between them lying in whether prisms or surface- or back-silvered mirrors are used at **M1** and **M2**. Some rangefinders have these reflecting surfaces static and use an auxiliary prism or prisms to adjust the angle of the secondary beam, but these are unsuited to amateur construction, and the simplest type uses a pivoted surface at **M1** only (**M2** being fixed).

The normal laws of reflection at a plane surface show that the angle through which **M1** is adjusted must be only half of the angle through which the secondary rays must be turned. The total movement to be provided for (and measured) is, therefore, likely to be no more than one or two degrees.

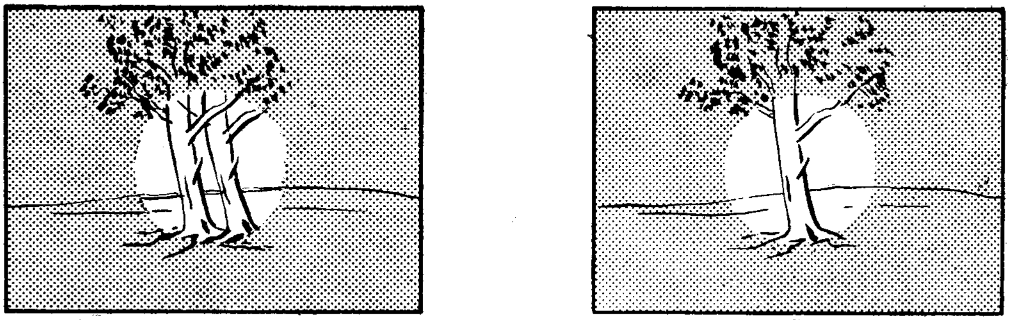
It is not found necessary (or in the interests of convenience, desirable) to make the rangefinder more than an inch or two in length, so the figure of 2 in. used above is likely to be a maximum. Similarly, it is unlikely that the instrument would be calibrated much below four or five feet since objects at very close ranges are likely to be both static and accessible, and direct measurement with a tape is practicable.

There is an inherent defect of this type of rangefinder which manifests itself at close ranges. The rays of light forming the secondary image inevitably travel a greater distance than the direct ones, an increase in this case of two inches.

The size of the image is, of course, inversely proportional to the distance so that the secondary image is always smaller than the primary; this is negligible at most distances, but at, say, 24 in. the secondary image would be only 12/13 of the size of the primary. This would obviously prevent accurate adjustment since the images could not coincide.

If three feet or so is fixed upon as a minimum range the results are quite satisfactory with the layout shown in Fig. 1.

It is not usual (or even desirable) that the fields of view of both apertures should be the same. Usually the primary view is larger, with the secondary image occupying a circular portion in the centre of it.



(a) (b)

Fig. 4

This assists in differentiating between them and incidentally facilitates construction since the secondary aperture can then be made about the same size as the primary.

This is illustrated in Fig. 3, in which the broken lines indicate the limits of the two sets of rays.

The further to assist differentiation, one image usually the primary, since it tends to be brighter, not having suffered double reflection, is tinted a light yellow. The secondary image is then seen as a light spot in the centre of the field of view. Fig. 4 shows the appearance when the rangefinder is (*a*) not yet adjusted and (*b*) correctly set for coincidence.

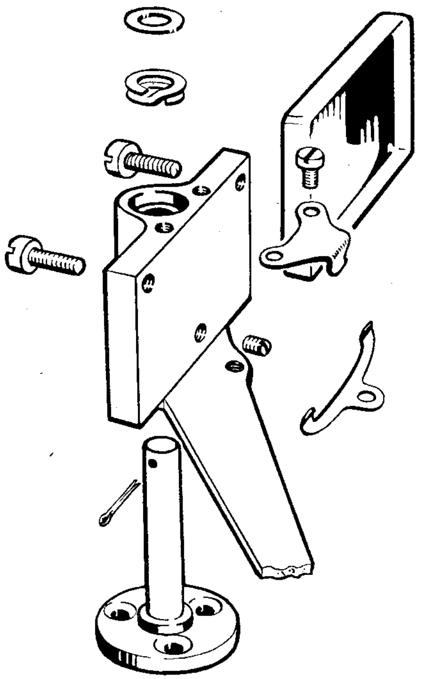


Fig. 5

The shape of the field of view has been shown rectangular since it is so convenient to make it agree with the picture area and thus use one aperture for view- and range-finding. It is not to be expected that, in a simple model as described, the precise limits of the field of view can be accurately delineated, since the edges of the primary aperture are too close to the eye to be precise. The indication is, however, quite good enough for centring a moving object or portrait, where the background is relatively unimportant, and it is in such applications that the time saved by using a combined range and viewfinder is valuable.

Where an auxiliary viewfinder is required for, say, landscape work, spare space is available in the body of the rangefinder for an additional fitting as described later; alternatively a simple wire frame could be hinged in the plane of the lens to form, with **V**, a simple frame finder.

It has been noted that **M2** must both reflect and transmit light. This could be achieved by using a semi-silvered or spattered mirror, but neither of these expedients is convenient for amateur use. Some experiments proved that a simple solution was possible.

It has been seen that the secondary image need be only a small proportion of the primary, and it follows that **M2** need, therefore, be quite small. Fig. 3 indicates the point, though in practice the mirror is smaller, particularly if it is shifted back as close to **V** as possible; here it is so close to the eye and so small as to be virtually invisible in itself, though the image reflected in it is, of course quite clear.

Both **M1** and **M2** may be ordinary back-silvered mirrors of optical quality, though if a small right angle (totally reflecting) prism is to hand it may well be used at **M1**. Mirror of adequate quality may be frequently encountered in surplus equipment, and the material used in the rangefinder described was taken from an old bubble sextant.

Construction

The basic construction will remain the same whether the instrument is required as a separate unit or for coupling to a camera.

A really rigid base is essential and no relative movement must take place between the mirrors except that involved in adjustment. A length of dural channel would be ideal for an independent instrument, the apertures being cut in the flanges, while the camera body itself may suffice for a coupled rangefinder. In either case the two mirror assemblies are built up separately and bolted to the selected base. Their distance apart is not critical and may be dictated by circumstances; about $1\frac{1}{2}$ to 2 in. is a reasonable choice.

The details of the pivoted mirror unit are shown in exploded form in Fig. 5. A dural block forms the mirror backplate, and this is drilled and reamed $\frac{1}{8}$ in. to fit the fixed pivot. The latter, of steel, is bolted to the base through its flange, and the bearing surfaces must of course be well fitted—rather stiff than otherwise. A thackeray washer trapped beneath the split pin holds the dural block downwards against a shoulder turned on the flange. The mirror is held towards the block by two bronze springs which are retained by 10-B.A. screws into the block; the back of the mirror actually locates against the head of one fixed 10-B.A. grub-screw (at the bottom) and the tips of two 10 B.A. adjusting setscrews near the top. Differential adjustment of the latter enables the mirror to be orientated in two planes.

To the bottom of the dural block is screwed an operating lever (as long as practicable) and placed at a convenient angle. This would lie along the axis of the base in a separate rangefinder, and be pressed by a spring at the tip against the end of a micrometer screw, the latter having a knob outside the case calibrated directly in distance by experiment. In a coupled system the lever shape must be determined by the existing focussing arrangements.

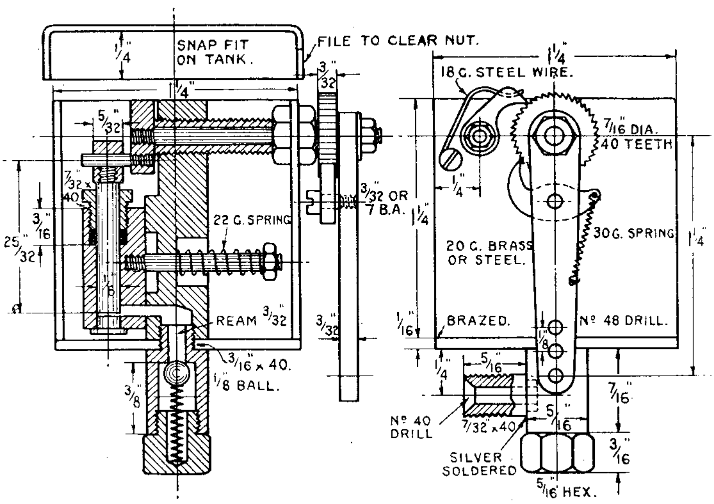
(*To be continued*)

"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

The Cylinder Lubricator

SOME weeks back, when writing about old times, I recounted an experience with an old L.B. & S.C. Railway piston-valve engine, which happened half-a-century ago—how time flies! In that episode I explained that adequate lubrication would have made all the difference in the world, to the proper working of the valves; unsatisfactory, the liners becoming scored, and the valves blowing badly. Our erstwhile (or ersatz!) friend Jerry tried them with success on his Nuremberg toy locomotives, but had to use wet steam and plenty of thin oil, even at the low pressure generated by his "pot" boilers. When he tried superheating, the valves all seized up.



Details of cylinder lubricator

and the same applies today. All modern locomotives have not only what the immortal Billy called a "forced-feed," but are provided with atomisers as well; no relation to the "big bang" (thank goodness!) but merely steam jets which convert the oil into a spray, which effectually performs the lubrication job for both piston-valves and main pistons. New readers may be interested to learn that it was the application of mechanical lubricators to little locomotives, that made tiny piston-valves a really practical proposition. It isn't the *quantity* of oil that matters so much; the vital factor is a regular and steady feed. The "hit-miss-and-gulp" antics of the displacement type of lubricator advocated by some of the older designers, sufficed for slide-valves and wet steam; as a matter of fact, it was the wet steam that did best part of the lubricating after the lubricator had gulped itself empty, in a few minutes or so!

In the early days of the Live Steam notes I received several letters from correspondents who had tried small piston-valves and found them

As older readers will know, your humble servant did a bit of experimenting with both piston-valves and mechanical lubrication; and the final result was my $2\frac{1}{2}$-in. gauge 4-6-2 *Fernanda*. I've just looked up her "date of birth," and find that it was April, 1934, so she is now 18 years of age. On a recent Saturday afternoon, she was doing the knots around my line, in charge of one of the top-link drivers from Camden Motive Power Depot (even *that* has gone "third programme"—we just called them "loco. sheds" or "steam sheds" in the good old days!). He was amazed at the "kick" she had, remarked on the sharp even beats and the absence of blowing, drove her in exactly the same way as his full-size *Princesses* and *Duchesses*, and said she was as good an engine as any of her big sisters. Her piston valves are as good now as when they were first put in; and the secret of that is simply correct lubrication. She has a lubricator of the type I am specifying for *Britannia*, and described below. I find that separate atomisers are not necessary in the small engines, because the oil,

when delivered slap into the path of the steam going to the cylinders, is automatically atomised into a spray, and this does the trick. Now on to construction.

Oil Tank

The easiest way to make the oil tank is to cut a strip of 20-gauge metal (brass or steel) 5 in. long and 1¼ in. wide, bend it into a rectangle 1¼ in. square, stand it on a piece of 16-gauge metal a little over 1¼ in. square, and silver-solder if brass, or braze if steel, all around the bottom, and the corner joint. Quench out, file the bottom flush with the sides, and be mighty careful that no trace of scale or grit is left on the inside, or you'll get piston-valve trouble. A snap lid can be made at the same time, by cutting out a piece of 20-gauge metal 1¾ in. square, nicking ¼ in. out of each corner, and bending ¼ in. of each side, to form a tray. Braze or silver-solder the corner joints, and be very Cohen-McPhersonish with the brazing material, or the lid won't fit. Leave the bends slightly rounded, as the lid doesn't have to go on full depth, otherwise it may foul the big-end of the pump ram on top centre. Drill a $\frac{3}{16}$ in. hole right in the middle of the bottom plate, and another ditto at $\frac{3}{16}$ in. from the top, on the centre-line of one of the side panels.

Pump Stand

The stand is made from a piece of $\frac{5}{16}$ in. square brass rod; either part off in the four-jaw, or saw off to full length, and square off to exact length in the chuck. Whilst it is running truly, centre the end, drill $\frac{3}{16}$ in. deep with 5/32 in. or No. 22 drill, and tap $\frac{3}{16}$ in. × 40. On one of the facets, mill or file a rebate ½ in. long and $\frac{1}{16}$ in. deep. At $\frac{3}{16}$ in. below that, cut a recess $\frac{5}{16}$ in. long and $\frac{1}{16}$ in. deep. Anybody who has a milling machine can do these jobs nearly as quickly as I can write the instructions; incidentally, I usually work the old mass-production stunt, same as I do for injectors, and part off half-a-dozen stands, gripping the whole lot in the machine-vice on the table of my milling machine, and doing both rebates and recesses with a $\frac{5}{16}$ in. end-and-face cutter on the arbor, at one fell swoop. They can be done in the lathe, by holding the blanks in a machine-vice on a vertical slide, and traversing across a $\frac{5}{16}$-in. end-mill or home-made slot drill held in the three-jaw; or can be held in a machine-vice on the lathe saddle, and traversed under a cutter on a mandrel between centres.

At $\frac{3}{16}$ in. from the top of the rebate, in the middle of the column, drill a 5/32-in. hole, and tap $\frac{3}{16}$ in. × 40. In the middle of the recess, drill a No. 41 hole clean through the column. These holes *must* be square with the working faces, so use either a drilling machine, or the lathe, to drill them, as per *Tich* instructions. The back of the No. 41 hole is opened out to 5/32 in. depth with ⅛ in. pin drill. Now comes a tricky bit. At 5/32 in. from the bottom, on the bit below the recess, and at $\frac{1}{16}$ in. each side of the centre line, drill two holes with No. 54 drill. That on the left, is only $\frac{1}{16}$ in. deep, and a groove is chipped from it, in the face, to the bottom of the stand. That on the right, is drilled right into the hole in the middle of the stand. As the drill meets the hole on the skew-whiff, watch your step as it breaks through, or away will go the point, and wee drills cost muckle bawbees the noo, ye ken; vot you tink, eh? Final job is to smooth the working faces by rubbing them on a fine flat file laid on the bench, and finishing on a piece of fine emery-cloth laid on the lathe bed, or something equally flat. Press gently and evenly on the back of the stand, when rubbing on file and emery-cloth, as the faces must be dead true, to prevent escape of oil.

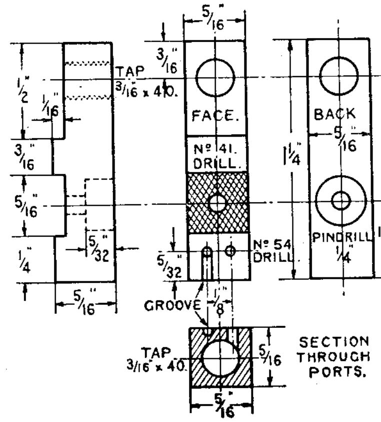
Pump Cylinder

The business part of the pump is made from a ⅝ in. length of $\frac{5}{16}$-in. square brass rod, faced to dead length as above. On the centre line of one end, at $\frac{3}{16}$ in. from one of the facets, make a centre-pop, and chuck in four-jaw with the mark running truly. Centre, drill right through with No. 33 drill, ream ⅛ in., open out to $\frac{3}{16}$ in. depth with $\frac{3}{16}$-in. drill, and tap 7/32 in. × 40. Make a weeny gland to suit, from ¼-in. hexagon rod, by same process as described for piston glands. At 3/32 in. from the bottom of the facet farthest away from the bore, and right on the centre line, drill the port with a No. 54 drill, right into the bore. At ¼ in. above this, drill a No. 48 hole, and tap 3/32 in. or 7 B.A. for the trunnion pin. Poke the ⅛-in. reamer through again, to remove any burrs, then turn up a little plug for the bottom of the hole, from $\frac{3}{16}$ in. rod. It should just reach to the bottom of the port, and should be a tight squeeze fit; solder over the head to make sure it doesn't come out. The head need only be 1/64 in. thick, or thereabouts.

Round off the side of the cylinder, as shown in the plan; face the working side truly, as described above, then screw in a trunnion pin made from 3/32-in. round silver-steel, threaded at both ends as shown in the illustration. Note—this must be exactly square with the working face; if it isn't, the rubbing faces won't make contact all over, and oil will escape between them. The pump ram is a piece of ⅛-in. round silver-steel shouldered down at one end to 3/32 in. screwed, and furnished with a big-end (some "big" end, at that!) filed up from a little block of brass, of suitable size. This is drilled No. 48; and the distance between the centre of the hole, and the end of the ram, should be 25/32 in., so as to allow a very small clearance between ram and plug on bottom centre, as shown in the section. If you prefer it, the big-end can be omitted, and the ram made from a plain bit of ⅛-in. silver-steel, with a cross-hole drilled for the crankpin; but as some good folk seem to have considerable difficulty in drilling a cross-hole truly on the centre of the rod, I have given the alternative as above. The trouble is this—that if the hole *isn't* on the centre of the rod, the port in the pump cylinder won't be exactly between the two ports in the stand, when the crank is on the dead centres, and the pump won't function properly. Any slight leak in the oil clacks will allow steam to blow back into the tank, and water will form in it, causing a failure of the oil supply. The pump cylinder is held to the stand by a spring and nut, as shown; you don't need too much spring pressure or the ratchet gear will be strained.

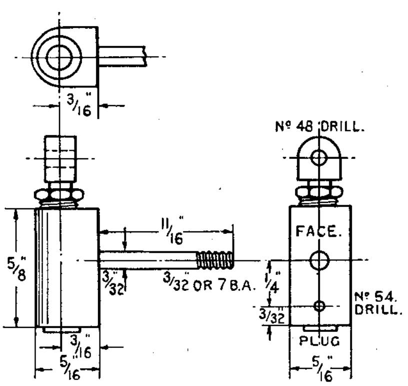
Crank and Bearing

The crank spindle is a $1\frac{5}{16}$-in. length of 3/32-in. round silver-steel, screwed at both ends, and furnished with a disc crank, made from a $\frac{1}{8}$-in. slice of $\frac{3}{8}$-in. round rod. This is tapped to suit, and carries a crankpin, made of 15-gauge spoke wire, screwed 9 B.A., and set at $\frac{1}{8}$ in. from centre, to give $\frac{1}{4}$ in. stroke to the ram. For the bearing, chuck a piece of $\frac{5}{16}$ in. hexagon rod in the three-



Pump stand

jaw, face the end, centre, and drill down about 1 in. with No. 41 drill. Turn down $\frac{3}{4}$ in. length of the outside, to $\frac{3}{16}$ in. diameter, and screw $\frac{3}{16}$ in. × 40. Part off to leave a head 3/32 in. thick; reverse, and chamfer. Make a nut $\frac{1}{8}$ in. wide, from the same material; another kiddy's practice job.



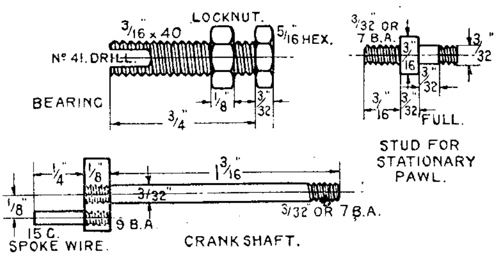
Pump cylinder

Check Valve

Chuck a piece of $\frac{5}{16}$-in. round rod, face the end, and turn down $\frac{1}{4}$ in. length to $\frac{3}{16}$ in. diameter. Screw $\frac{3}{16}$ in. × 40, and face off the end until the screwed part is $\frac{3}{16}$ in. long, so as to ensure full thread to the end. Part off at $\frac{7}{16}$ in. from the shoulder. Reverse in chuck; centre, drill right through with No. 43 drill, open out and bottom to $\frac{3}{8}$ in. depth with $\frac{3}{16}$-in. drill and D-bit, tap the end 7/32 in. × 40, and poke a 3/32-in. reamer through the remnants of the 43 hole. Drill a 5/32-in. hole in the side; and in it, silver-solder a nipple, or union screw, made from 7/32 in. round rod, and screwed 7/32 in. × 40 as shown. The cap is made from $\frac{5}{16}$-in. hexagon rod, and drilled No. 30, as shown in the section, to form a housing for the spring keeping the ball in place. Seat a $\frac{1}{8}$-in. ball on the hole at the bottom of the recess, and secure with spring and cap as shown. The spring should be wound up from 24-gauge wire, and should have both ends ground off square, by touching them lightly on the side of a fast-running emery-wheel. The spring should just begin to compress, as the screw of the cap engages.

How to Assemble the Lubricator

Pack the pump gland with a few strands of graphited yarn, and attach pump cylinder to stand. Put the spigot of the check valve through the hole in bottom of tank, and screw the pump on to it, so that it can just be turned by finger pressure. Insert the bearing through hole in



Crankshaft and bearing

side of tank, put on the lock-nut, and adjust stand until the bearing can be screwed into it, as shown. Screw in until the head of bearing just touches side of tank without putting any strain on the stand, then run lock-nut back against side of tank, and tighten up. Finally, screw the check valve home, so that the nipple points to the back of tank. Simple job, isn't it?

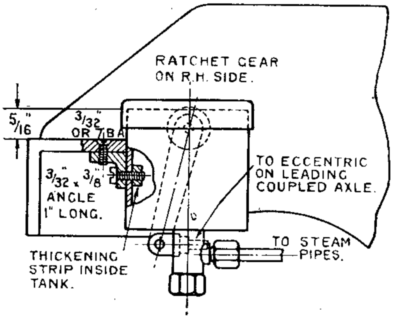
Ratchet Gear

Our approved advertisers should be able to supply suitable ratchet wheels. Press the wheel on to the spindle, to such a position, that when the spindle is in place, and the crank is screwed on, the spindle has just the weeniest bit of end play. The wheel, if drilled No. 43, should press on the spindle nicely, and need no further fixing; but it may be silver-soldered if desired. Mind that you have the buttress teeth in the position shown in the drawing! The ratchet lever is filed up from a bit of $\frac{1}{4}$ in. × 3/32 in. steel strip, and drilled as shown; the pawls are filed from steel of same thickness. They should be case-hardened, as described for hardening *Tich* parts; or they may be filed up from ground flat stock (cast steel) and hardened and tempered to dark yellow. The moving pawl is attached to the ratchet lever by a 3/32-in. or 7-B.A. screw with 3/32 in. full length of "plain" under the head; I always make my screws for jobs like these. A light spring, about 30-gauge, connects the

hole in the tail to the hole in the lever, and ensures positive engagement when the engine is running fast.

The stationary pawl is mounted on a stud turned from a bit of $\frac{3}{16}$ in. round steel, to dimensions shown in detail sketch. The fully screwed end is poked through a 3/32-in. hole drilled in the oil tank, level with the crank spindle and $\frac{1}{4}$ in. from the back, and secured with a nut inside the tank. The pawl goes on the outside, and is secured by a nut and washer; it must be perfectly free. It is kept in engagement with the ratchet wheel, by the same device as used on most clocks, viz. a wire spring, bent to the shape shown, so as to lie in a groove filed in the "bird's head." The tail of the spring is attached to the oil tank by a screw, nutted inside the tank.

The erection is a simple job. On the front of the lubricator tank, at $\frac{7}{16}$ in. from the top, fix a 1-in. length of 3/32-in. × $\frac{3}{8}$-in. angle brass. As the metal of the lubricator isn't thick enough to take a thread, drill three screw-holes in the angle with No. 40 drill. Cut a piece of $\frac{3}{8}$ in. × $\frac{1}{8}$ in. strip brass 1 in. long, clamp it to the angle against the holes, and run the drill through them, making countersinks in the strip. Drill No. 48, and tap 3/32 in. or 7 B.A. Now temporarily clamp the angle to the oil tank; drill the holes, using those in the angle as guide, file off any burrs inside, put the tapped strip inside the tank, and run the screws through angle and tank, into it, as shown in the section. That will be better than loose nuts inside the tank. You can sweat the angle as well, if desired.



How to erect the lubricator

Drill a No. 40 hole in the middle of the top of the buffer beam, $\frac{3}{16}$ in. from the inner edge, and another at $\frac{5}{16}$ in. each side of it. Countersink them, and attach the lubricator by 3/32-in. or 7-B.A. countersunk screws going through them, into tapped holes in the angle, as shown in the illustration. This will hold the oil tank, so that the ratchet lever is clear of the bogie frames. Make a little fork from $\frac{1}{4}$-in. square rod, as described for valve-gear, and attach it to the eccentric on the leading coupled axle, by a $\frac{1}{8}$-in. steel rod screwed at both ends; the length is best found by measurement from the actual engine. The fork is coupled to the bottom of the ratchet lever by a 9-B.A. bolt made from 15-gauge spoke wire, and the fork is adjusted on the rod so that the lever swings equally each side of centre, the ratchet clicking one tooth per revolution of the coupled wheels.

Die-Castings in Machine Tools

Our opinion has been asked regarding the advantages or disadvantages of using die castings for the components of machine tools. It has been suggested that such components are inferior from the point of view of wearing quality or precision than those made by the more usual methods.

The term "die casting" covers a wide range of products, the only property common to all being that they are cast in permanent or semi-permanent moulds, usually of metal. Nearly all metals can be die-cast, but the practical and economic possibilities of the process are, generally speaking, limited to metals or alloys which have a relatively low melting-point, and high fluidity in the molten state.

The great majority of die castings used in industry are made in a zinc alloy known in this country as Mazak, which is particularly well suited to rapid production of castings in pressure dies. It is possible to produce these to a high degree of precision, and to reproduce details which would be impossible by sand casting, even to keyways, splines and screw threads if desired, so that little or no machining is necessary after casting. This alloy is harder than many of the common non-ferrous alloys, and has corresponding physical strength and durability under static conditions. Aluminium alloys are also die-cast, but are much more difficult to cast in pressure dies, and gravity dies are more commonly used in this case, with some loss of detail and less expeditious production.

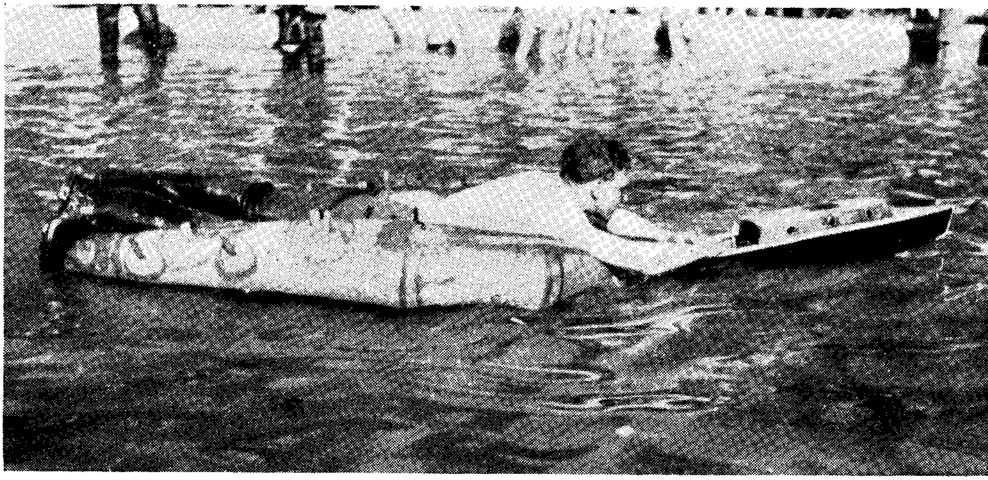
In all classes of engineering, Mazak die castings have been used extensively, particularly for the smaller components, which do not have to withstand excessive working stresses or vibration. They are quite legitimately applicable to such components in machine tool practice, and such parts as gear guards, handles or handwheels for feed controls, etc., are quite satisfactory in this material. It should be remembered that where time and machining cost can be saved in the production of a minor component, it is often possible for manufacturers to devote more attention to parts that are more important, or to produce a good utility product at a lower price.

Mazak die castings are not usually favoured for precision working parts, such as faceplates, chuck bodies, gear wheels, etc., at least in this country. One of the disadvantages of these castings is that they are somewhat liable to slow distortion, so that components initially made to close limits of accuracy may go out of truth in course of time. The relatively low fatigue resistance of the alloy makes it liable to failure through crystallisation, as a result of working stress or vibration. But much depends on the care and control in casting, and the design of dies. Gravity castings in aluminium alloys are generally much better in respect of stability and fatigue resistance.

Model Power Boat News

by "Meridian"

Recent Regatta Activities



Mr. J. H. Benson with "Comet" in the towing race at Welling

JUDGING by the entries at the opening regattas of the 1952 season, the interest in model power boats is higher than ever, and promises large attendances for forthcoming events.

A large entry list often presents a problem regarding the organisation of regattas, especially where formerly the number was fairly small. In former times, the time element did not matter much, and long lunch intervals and unlimited periods on the line were fairly general. If a regatta was late in starting, no one worried very much; in fact, it was quite normal for competitors to turn up about an hour later than the advertised starting time and still be in time to make their entry before the first event commenced.

Last season, however, it was fairly obvious that some clubs were unprepared for the numerous entries at their regattas, and consequently some events did not end until late in the evening.

This question of regatta organisation was brought up at the annual general meeting of the M.P.B.A., and as a result some recommendations were made. Among other things, a time limit for starting in the speed events was advocated, and also precedence for steam boats in steering and other "straight" events.

By the showing of this year's regattas, so far, it is evident that clubs are really making efforts to improve organisation. At Bournville in particular, the regatta ended by 5.30 p.m., in spite of a heavy entry in all classes, and a rainy afternoon—and rain is the acid test of regatta organisation!

Victoria M.S.C. Regatta

A total of over 70 entries made this event one of the biggest inter-club regattas ever held at Victoria Park, if one excludes the Grand Regatta attendances of recent years. It is believed, however, to be a record attendance for a Victoria M.S.C. regatta.

The Nomination Race and the Steering Competition were contested by over 40 different boats, including entries from Swindon and Southend, besides the nearer clubs. The nomination event was won by R. Brown (Victoria) with his magnificent tug *S. A. Everard*, and the steering competition by J. Slender (Welling) after a tie with J. Benson (Blackheath).

In the speed events, all classes were well supported, and speeds quite high, some of the winning speeds reaching over 57 m.p.h. Several new boats made an appearance, including a new "B" class hydroplane, M. Daly's *Nipper* (Blackheath) which took a second place, and F. Jutton's flash steamer *Vesta II* which now has a new hull of original design, although teething troubles are apparent.

The final placings in the various events were as follows :—

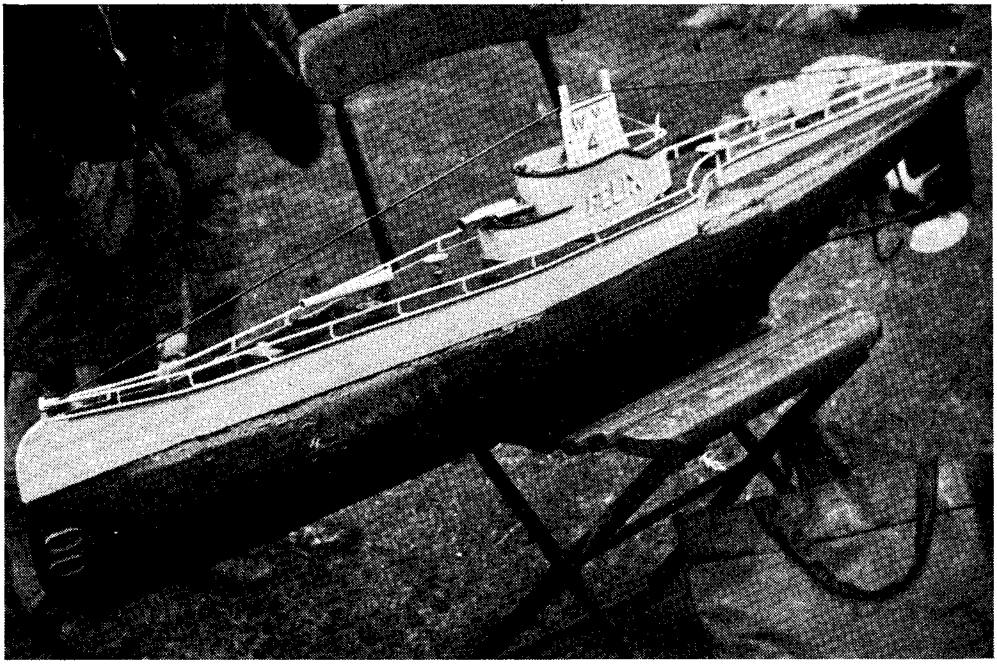
Nomination Race 80 *yd.*

1. R. Brown (Victoria), *S. A. Everard*: 0.25 per cent. error.
2. T. Curtis (Victoria), *Micky*: 1.15 per cent. error.
3. J. Slender (Welling), *Sarah Ann*: 1.5 per cent. error.

Welling Regatta

A pleasant regatta for free-running boats was held on Whit Saturday by the Welling & Dis. M.E. Club. By permission of the local authorities, the event was held at Belvedere Recreation Ground, Erith. The pond has the disadvantage of an obstruction in the centre, which prevents the possibility of round-the-pole events, but the addition of a towing race and a team nomination event, besides the usual straight events, kept up the interest and entertainment for both competitors and spectators alike.

Competitors in the towing had to lie spread-eagled on an ex-R.A.F. rubber dinghy, and although no one went overboard, several got very wet in the proceedings!



Mr. Hinton's model submarine "Felix"

Steering Competition

1. J. Slender (Welling), *Sarah Ann*: 11 + 3 + 5 points.
2. J. Benson (Blackheath), *Comet*: 11 + 3 + 3 points.
3. R. Brown (Victoria), *S. A. Everard*: 9 points.

"D" Class Race 500 *yd.*

1. Hyder (Victoria), *Slipper I*: 37.6 m.p.h.
2. Woodley (Enfield), 35.6 m.p.h.

"C" Restricted Race 500 *yd.*

1. S. Poyser (Victoria), *Rumpus* 3: 56.15 m.p.h.
2. Hancock (S. London): 45.0 m.p.h.

"C" Class Race 500 *yd.*

1. B. Miles (Kingsmere), *Dragonfly* 3: 50.88 m.p.h.
2. Walton (Kingsmere): 37.5 m.p.h.

"B" Class Race 500 *yd.*

1. G. Lines (Orpington), *Sparky II*: 57.5 m.p.h.
2. M. Daly (Blackheath), *Nipper*: 46.9 m.p.h.

"A" Class Race 500 *yd.*

1. E. Clarke (Victoria), *Gordon II*: 57 m.p.h.
2. G. Lines (Orpington), *Big Sparky*: 53.9 m.p.h.

Steering Competition

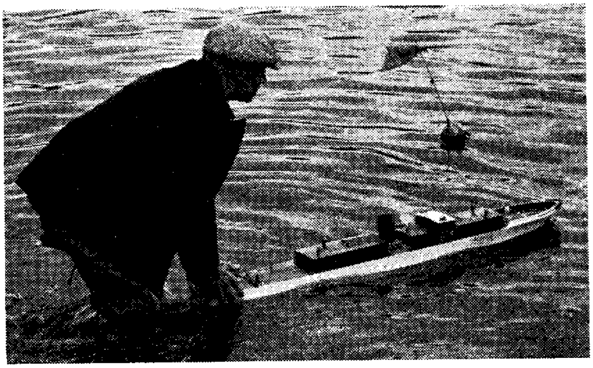
1. Clark (Welling): 11 points
2. A. Clay (Blackheath), *Elizabeth*: 9 + 5 points.
3. J. Benson (Blackheath), *Comet*: 9 + 3 points.

Nomination Event

1. S. Dearling (Blackheath), *Maj.*
2. F. Curtis (Kingsmere), *Korongo.*
3. E. Vanner (Victoria), *Leda III.*

Team Nomination Relay Race

1. Blackheath, Messrs. Benson, Clay, Dearling: nom. 60; actual 58.2.



The winner of the steeering competition at Bournville, Mr. C. Nicholls's "Endeavour"

Towing

1. S. Dearling (Blackheath), *Maj.*: 61 sec.
2. J. Slender (Welling), *Sarah Ann*: 68.5 sec.

Radio Control

1. Rowe (S. London).

Bournville Regatta

The annual Bournville Whitsuntide regatta always attracts a good entry from both provincial and London clubs, and this year entries were more numerous than ever. A new club to take part was Wallasey, with several interesting prototype boats. Mr. Hinton of this club ran an unusual model—a submarine, although it was run on the surface in the steering event. Later in the day, Mr. Hinton gave a short demonstration of surfacing and diving, which was much appreciated by the onlookers.

The Steering Competition was the opening event, and was keenly contested by many crack steering boats. Finally the Cheltenham club produced the winner in Mr. Nicholls's *Endeavour* The winner of this event holds the A. Hackett Steering Trophy for one year.

The speed events were well supported in all classes, although there were many capsizes during the racing. This appeared to be due to a swell on the water surface, which did not seem to be unduly choppy.

Mr. G. Lines (Orpington) pulled off the "double" by winning both the "A" and "B" events with *Big Sparky* and *Sparky II* respectively. It was noted that most competitors with i.c. engines had trouble in finding jet settings—perhaps there's something different about the air at Bournville!

There were one or two new craft making a regatta debut, including a new 10 c.c. job by Mr. R. Mitchell (Runcorn) which looks promising, although a certain amount of instability was apparent.

Mr. K. Williams (Bournville) had bad luck, when on attempting to start *Faro's* engine a sudden stoppage occurred, causing *Faro* to be withdrawn. The trouble was found to be due to a broken connecting-rod.

Speeds on the whole seemed to be lower than the usual performances of the various boats, although the drizzle of rain that fell during the speed events was probably responsible.

A good run was made by Mr. S. Poyser's *Rumpus* (Victoria) to win the "C" Restricted Race, but Mr. Phillips *Foz* (S. London) was decidedly off form in the "C" event, although managing to beat Mr. R. Mitchell's entry, *Gamma*, by a "short head."

Steering Competition

(1) Mr. Nicholls (Cheltenham), *Endeavour*: 7 points.

(2) J. H. Benson (Blackheath), *Comet*: 6 points.

(3) W. Hood (Swindon), *Truant*: 4 points.

Mr. C. Stanworth with "Mephisto II" ("C" class)

Class "C" 500 yd.

(1) R. Phillips (S. London), *Foz*: 44.2 m.p.h.

(2) R. Mitchell (Runcorn), *Gamma*, 43.2 m.p.h.

Class "B" 500 yd.

(1) G. Lines (Orpington), *Sparky II*: 47.2 m.p.h.

(2) R. Mitchell (Runcorn), *Beta II*: 44.7 m.p.h.

(3) T. Dalziel (Bournville), *Naiad II*: 40.2 m.p.h.

Class "C" Restricted 500 yd.

(1) S. Poyser (Victoria), *Rumpus III*: 52.0 m.p.h.

(2) L. Pinder (S. London), *Rednip 8*: 50.3 m.p.h.

Class "A" 500 yd.

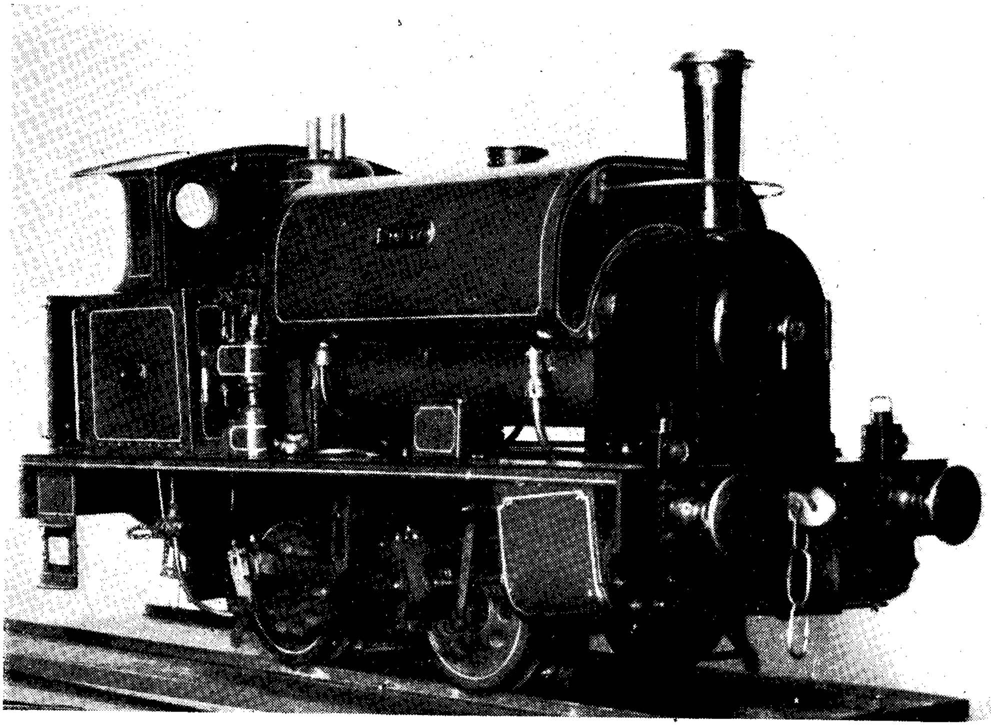
(1) G. Lines (Orpington), *Big Sparky*: 55.5 m.p.h.

(2) B. Pilliner (Southampton), *Frolic*: 45.4 m.p.h.

(3) A. Morris (Bournville), *Rangi*: 34.2 m.p.h.

A FIVE-INCH LIGHT-WEIGHT

by E. B. Hughes



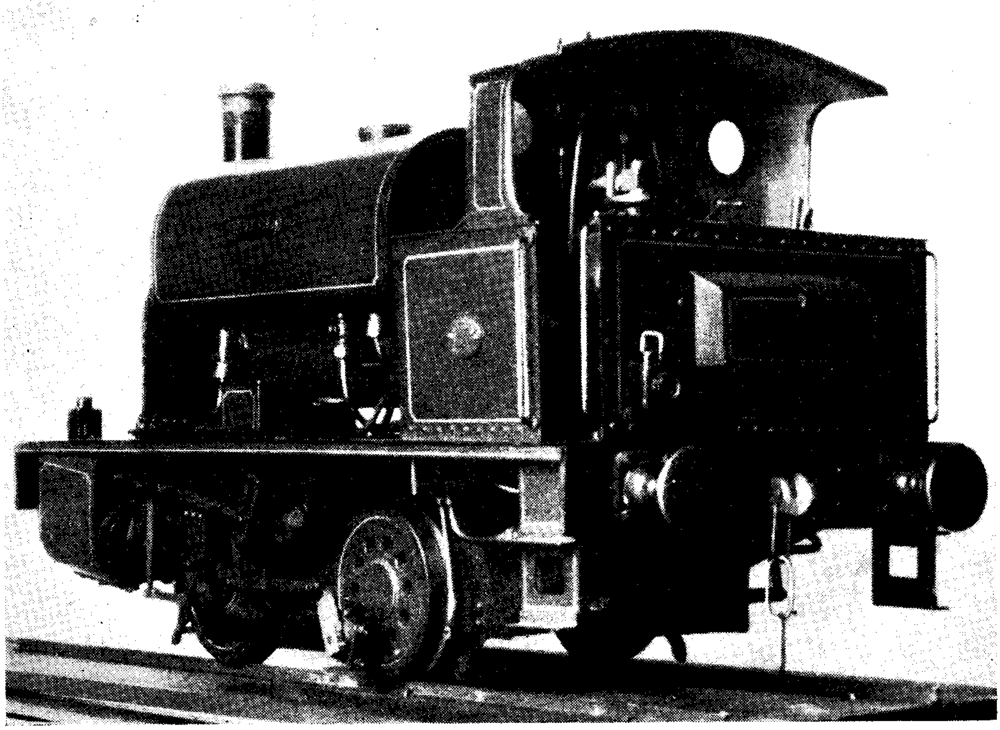
AFTER 35 years of riding on the "2½ in. Elevated," I began to yearn for a railway at ground level where points were possible, derailments unimportant and the garden unblemished(?) I consider 5-in. gauge the narrowest that one can balance oneself on, so during the last few months of the war designed this model in an attempt to make one more powerful than a 2½ in., but little heavier to handle.

The length over buffer is only 21½ in., boiler 13½ in. × 3⅝ in., wheels 3¼ in., cylinders 1 3/32 in. × 1¾ in., weight empty 44 lb., and whilst the engine is not as impressive as, say, a Royal Scot, I do think the appearance is most workmanlike.

Since it is a "free-lance" design, I put the Walschaerts links in trunnions instead of brackets, and the inner end of the shaft carries a small arm to operate the oil pumps. These latter were originally fixed ram and scotch crank type and were most unreliable, so I changed them to the oscillating pattern, and they now give no trouble. The top joint of the combination lever is a flush silver-steel pin kept in position by being overlapped by a cheek on the radius-rod, so only one nut is visible. Two pumps supply the boiler with water and are driven off the leading axle, as the firebox extends nearly to the trailing axle, this is kept free of eccentrics.

I collected all the material for the locomotive directly I was demobbed (Group 1). Cylinder castings, metal for axleboxes frames etc. I obtained fairly easily. Wheels were cast to my pattern ; but, when it came to copper for the boiler I struck trouble, so the backhead is a lighter gauge than I should have liked (but is specially well stayed to make up for it) and the four superheater tubes are $\frac{9}{16}$ in. only instead of ¾ in. A separate two-element $\frac{3}{16}$-in. superheater is used for each cylinder and the old type of brazed spearhead joints are used to reduce obstruction of the tube as much as possible ; still, extra care must be taken to keep these tubes clear, of course, owing to their small size.

Most of the brazing was done in a friend's forge ; but I had to leave London before the boiler was completed, so the job was in abeyance for a year or two, and then in desperation, I sent the completed boiler to one of our "M.E." advertisers for the final braze-up. Unfortunately, I have no garden now where I can lay a track, but on the test bench the boiler steams freely and the engine will run until the pressure-gauge



goes to zero. I have no doubt about the capabilities of the model and I wish I was not the only model locomotive enthusiast in this part of Sussex (Seaford), or I might get running powers on somebody's line.

There is no doubt this type of locomotive in 5-in. gauge offers much less "finicky" work in construction than a $2\frac{1}{2}$-in. gauge *Britannia*. Pipes, nuts, etc., are much less out of scale; sharper curves can be negotiated, and such an engine is definitely more suitable for passenger hauling.

Still, every man to his taste, and variety is the spice of life!

Railways and Coal

Recently, at a joint meeting of the Institute of Fuel and the Institution of Locomotive Engineers, Mr. R. G. Jarvis, of the Railway Executive, Southern Region, read a paper dealing with the fuel-economy measures which have been adopted by British Railways. Much progress has been made in locomotive design, for whereas figures of 5 to 6 lb. per drawbar horsepower hour were frequently recorded in dynamometer tests 25 years ago, modern locomotives on the same class of work require only 3 to $3\frac{1}{2}$ lb.

Recruitment and training of footplate staff, and their subsequent instruction, are now designed to ensure that, as far as possible, the best methods of firing and driving are employed and that coal is not wasted by unskilful handling of locomotives.

Mr. Jarvis dealt with pulverised fuel, oil fuel and mechanical stoking as alternatives to the conventional system of hand-fired coal-burning locomotives, and with the development of "engine" design, including condensing, compounding and various types of valve gear.

Finally, a survey was given of the design and performance of modern steam locomotives which, it was pointed out, have a boiler efficiency of 70 to 75 per cent., and of the methods used for testing locomotives. It was concluded that, in present circumstances, there is no practical alternative to the existing policy of working trains with the orthodox steam locomotive while, at the same time, exploring all possible means of saving coal.

As might be expected, the paper aroused a lively discussion, for there are many people who regard certain matters dealt with by Mr. Jarvis as being controversial. Electrification, dieselisation and gas turbine locomotives are developments, each of which can, in its way, put up strong claims as an alternative to the steam locomotive. At the end of a long and illuminating discussion, however, there seemed to be little or no reason why the views expressed by Mr. Jarvis should be modified; the ruling consideration lies in the words: "*in present circumstances.*"

Setting and Aligning the Vertical Slide on the Lathe Saddle

THE vertical slide is a most useful addition to the lathe for all manner of small milling jobs, as well as for mounting accessories that require a means of height adjustment.

The work can be held in place either by using clamps and T-bolts, or it can be gripped in a small machine vice attached to the table of the slide.

Lathe manufacturers generally supply a vertical slide designed specially for their lathes ; moreover, machine vices from the same source will be found readily attachable to the table, as the bolting lugs and the T-slots are spaced to correspond.

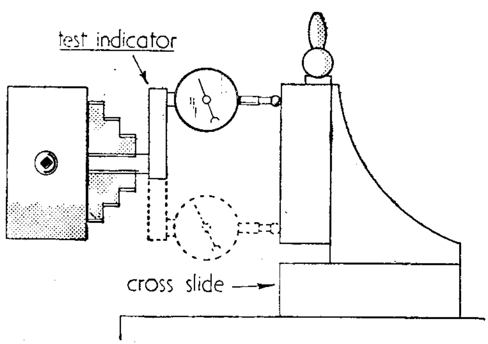


Fig. 1. Checking the vertical slide with the test indicator

Testing the Vertical Slide

A vertical slide of reputable make will have been tested and found correct before leaving the factory, but should there be any doubt in the matter, it is as well at the outset to carry out a simple test to determine whether the slide lives up to its name and really does stand vertically on its base.

In a lathe of good quality it may be taken for granted that the methods employed in manufacture ensure that the surface of the cross-slide, or boring table, lies truly parallel with the lathe axis, and a well-made vertical slide will, therefore, stand exactly at right-angles to this axis.

Carefully clean the surface of the cross-slide and the underside of the vertical slide base ; bolt the slide firmly in place so that the table lies, as nearly as can be judged, squarely across the lathe. As represented in Fig. 1, the test indicator is next mounted in the chuck with the plunger in contact with the table surface. The mandrel is now slowly turned by hand, taking care to lift the plunger over the T-slots, and readings are taken at the highest and lowest points on the circular path thus traced. If these two readings are similar, it shows that the slide stands vertically, and any discrepancy will indicate whether the slide leans forwards or backwards. It should, however, be pointed out that there will be less risk of taking false readings if the slide is set so that the indicator records, as nearly as possible, a constant reading throughout the whole of the turning circle. Those who are handy with a scraper will have little difficulty in correcting the under surface of the base to make the attachment stand vertically.

Aligning the Vertical Slide

When the work is secured to the face of the table, the slide will, for most purposes, be set with this surface lying exactly at right-angles to the lathe axis, that is to say parallel with the chuck face. This setting can readily be carried out, in the way already described, by mounting the test indicator in the chuck and taking readings at two diametrically opposite points on the horizontal line, as shown in Fig. 2. The base of the slide is then reset until these two readings no longer vary.

A quicker and quite effective method is to place a straight-edge or parallel rule against the face of the chuck, as in Fig. 3 ; the saddle is then moved forward, and the slide is adjusted until even contact is established between the projecting edge of the rule and the face of the chuck.

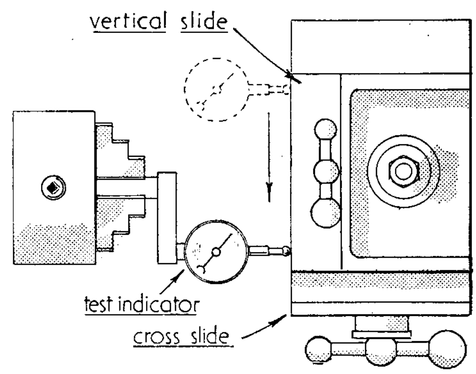


Fig. 2. Using the test indicator for aligning the slide table

Vertical slides are commonly attached to the lathe cross-slide by means of an angle bracket, so that the table with its feed mechanism can be tilted to any required angle ; the angular setting is then made with reference to the circular scale engraved on the casting. To set the direction of feed exactly vertical, it should be sufficient to bring the index mark into line with the zero of the scale, but if the base is not graduated, or

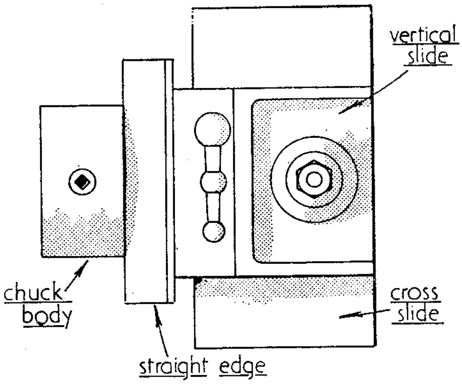


Fig. 3. Aligning the slide with a straight-edge

the accuracy of the scale is in doubt, a quick way of making the setting is to slacken the pivot bolt and then bring the lower edge of the table into contact with either the lathe bed or the surface of the cross-slide ; in the same way, angular settings of the slide can be made with the aid of a protractor resting on the lathe bed.

Setting the Work

Where, for example, a keyway has to be milled in a shaft gripped in a machine vice attached to the vertical slide, it is essential that the fixed jaw of the vice should be aligned exactly parallel with the cross-slide, which is used for feeding the work to the milling cutter. For this purpose, the test indicator is mounted in the chuck and, at the same time, the lathe mandrel is locked. As illustrated in Fig. 4, the plunger of the test indicator is brought to bear on the fixed vice jaw, and the cross-slide is then fed backwards and forwards for the full length of the jaw, until the needed adjustment has been made to give a constant reading. This adjustment can usually be made by altering the position of the vice, but if necessary the angular setting of the slide itself will have to be changed.

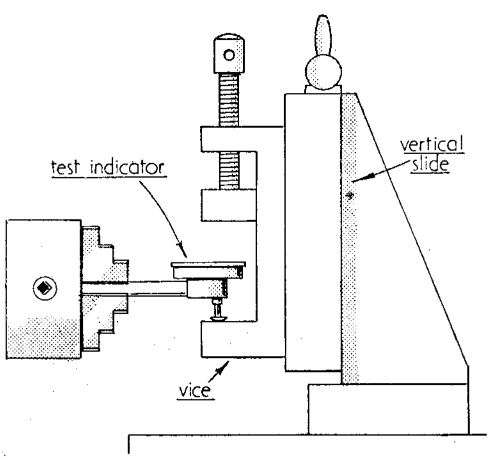


Fig. 4. A method of setting the fixed vice jaw horizontal

When applying the test indicator to the vice jaw, it may be found that with some instruments the contact point cannot be brought to bear. In this event, the difficulty can be overcome, as illustrated in Fig. 5, by gripping a length of flat steel in the vice and using the reverse attachment of the indicator to make contact with the under side of the material.

If a test indicator is not available for this purpose, the vice can be aligned by setting the two overhanging ends of the steel strip at an equal distance from the lathe bed surface with the aid of a rule, or by using the inside calipers. The work is set square across the lathe axis in either of the ways already described for aligning the slide table.

Accurate Feed Adjustment

If the lathe is furnished with graduated indexes on the cross-slide and the leadscrew, the exact amount of feed, both across and along the lathe bed, can, of course, be accurately measured. For determining the feed in the vertical direction, the vertical slide should be fitted with an index graduated in thousandths of an inch ; moreover, time will be saved and the risk of error reduced if the index is made adjustable and is provided with a locking-screw. With a fixed index, on the other hand, it may happen that the index reads, say, $93\frac{1}{4}$ when starting to remove 35 thousandths of an inch from the work ; how much easier it is to set the index to zero and then take a cut of 30 thousandths, followed by a finishing cut of 5 thousandths.

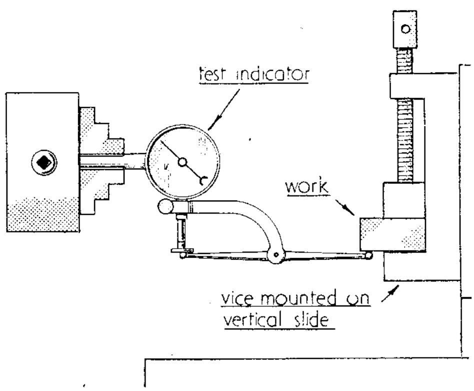


Fig. 5. The reverse attachment of the indicator used for aligning the vice

The making of adjustable indexes with frictional control and positive locking has been described in THE MODEL ENGINEER, and one of these fittings will be found a most useful addition to the feedscrew of the vertical slide.

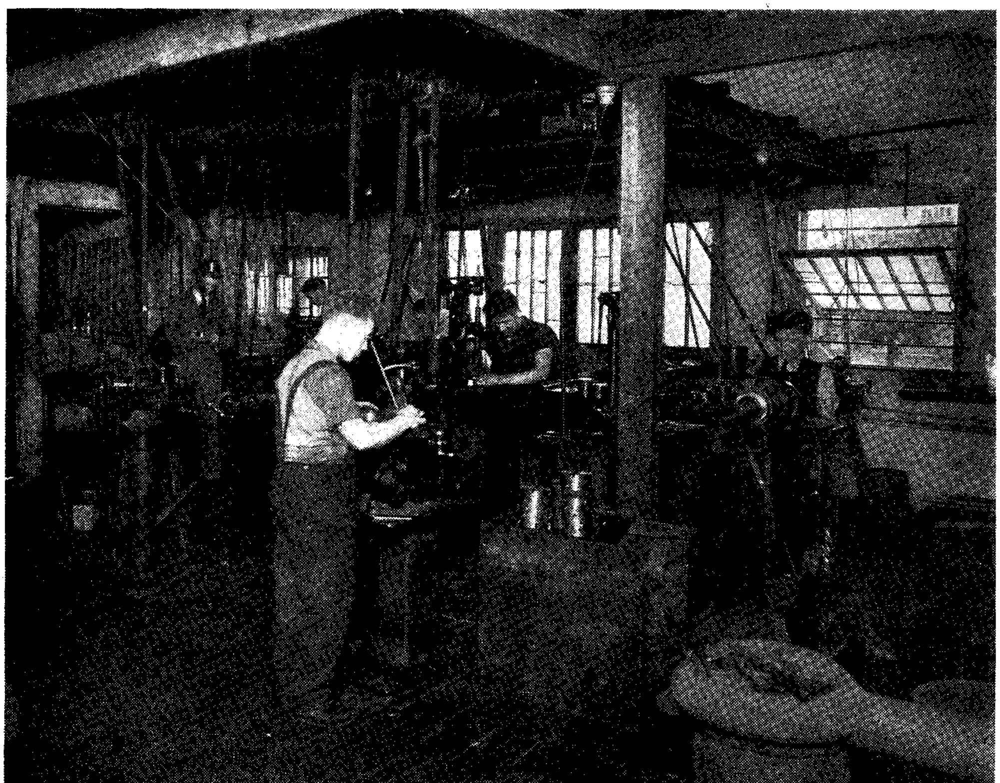
LATHE CHUCK MANUFACTURE

An insight into the methods employed by a well-known British firm specialising in this line of production

THE term " chuck" has been used in the past to define a wide variety of work-holding appliances, which were often very primitive in design, and sometimes constructed by the lathe operator as and when required for a particular job. Of more recent years, however, the term has taken a more specific meaning, and the modern chuck has become a precision appliance, which is not only a most important or even indispensable item of lathe equipment, but has also played an important part in the development of machine-tool design, and its application to more and more exacting production duties. Although many types of machine tools nowadays are equipped with chucks, their most important application is still in conjunction with the metal-working lathe, which even in its simplest form, now provides for the fitting of standard chucks to the work mandrel.

Users of chucks often take them for granted, and rarely stop to consider the problems of their construction, or the pains which have been taken by the makers to produce an appliance adequate for the duties demanded of it. While a chuck is a relatively simple mechanical device, the difficulties involved in making it at once accurate and robust are considerable ; all its working parts are very highly stressed in use, and the most minute inaccuracies in any of them are sufficient to condemn it in the eyes of the meticulous user. It may be said that a chuck is one of the appliances which is never appreciated, and, in fact, hardly noticed, until it fails to fulfil the duties expected of it, often as a result of long neglect and abuse.

The commercial manufacture of chucks of the type generally accepted at the present day originated in the U.S.A. during the last century, one



A part of the original factory at Putney

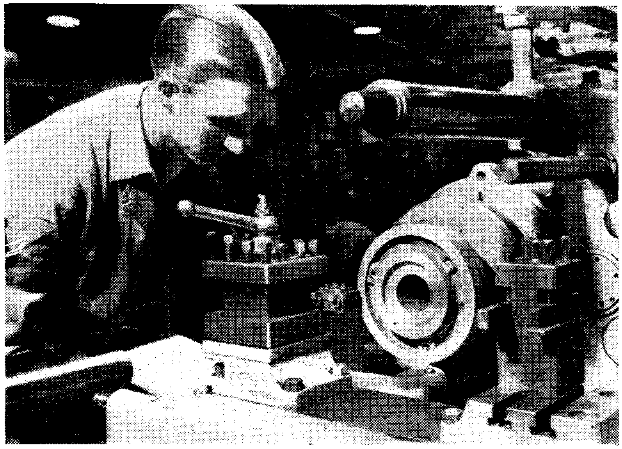
of the earliest specialist firms being founded by A. F. Cushman, who was a son-in-law of Simon Fairman, patentee of the self-centring chuck. In 1876, chuck manufacture was taken up in Sweden, but it was several years later before any attempt was made to produce chucks on a serious commercial basis in this country.

One of the first firms to specialise in chuck production in Britain was that of F. Burnerd & Co. Ltd., of Putney, which was founded in 1912 by the late Mr. H. R. Tracy. Originally, the main products of the firm were optical instruments, including astronomical telescopes, but general engineering work was also undertaken, and this led to an interest in machine-tool appliances. The first enterprise in this direction was the Burnerd Patent Parting Tool Holder, first produced in 1913, which proved a boon to users of small lathes, and many model engineers have cause to regret the fact that it ceased to be produced in 1930.

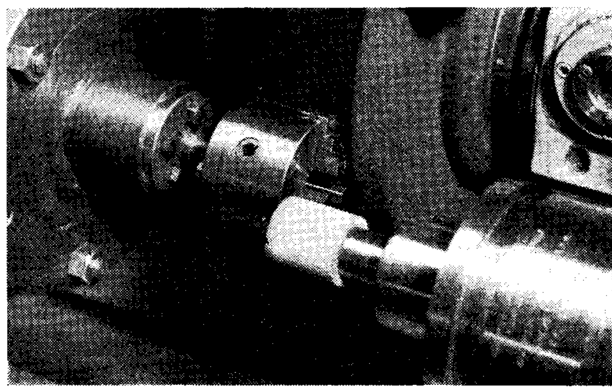
The first chuck introduced by this firm was the 3 in. lever scroll self-centring type, similar to that favoured by Continental makers of precision lathes; this chuck made its appearance in 1923, and with detail improvements, is still manufactured. A 6 in. light type independent chuck followed within a year or two, and in 1930 a new design of all-steel 4 in. independent chuck was introduced, which has ever since been a favourite among model engineers owing to its durability and facility of fine adjustment. From that date onwards the firm has specialised entirely on chuck manufacture, and now produces a full range of chucks, both self-centring and independent, from 2½ in. to 12 in. diameter. It is worthy of notice that the requirements of the model engineer, and other users of light lathes, have always been given the most careful consideration by the makers of Burnerd chucks.

In common with many firms which have made a name in the engineering world, this one rose from very small beginnings. The original works at Dryburgh Road, Putney, had a floor area of 2,500 sq. ft., not much more than half of which was utilised as a machine shop. Equipment comprised three or four lathes, two small planers, two milling machines, two drills, a universal tool grinder and a power hacksaw.

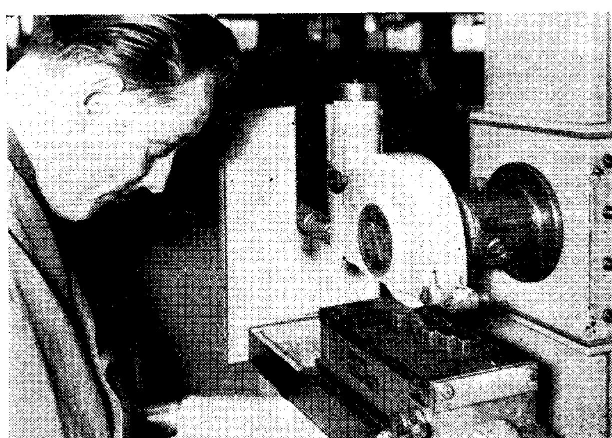
The death of Mr. H. R. Tracy, after a long illness, in 1934, was a serious blow to the firm, but the business was very ably carried on by Mrs. I. L. Tracy, assisted by her son,



Turning chuck bodies on a heavy turret lathe



A close-up of the grinding operation on the steps of chuck jaws



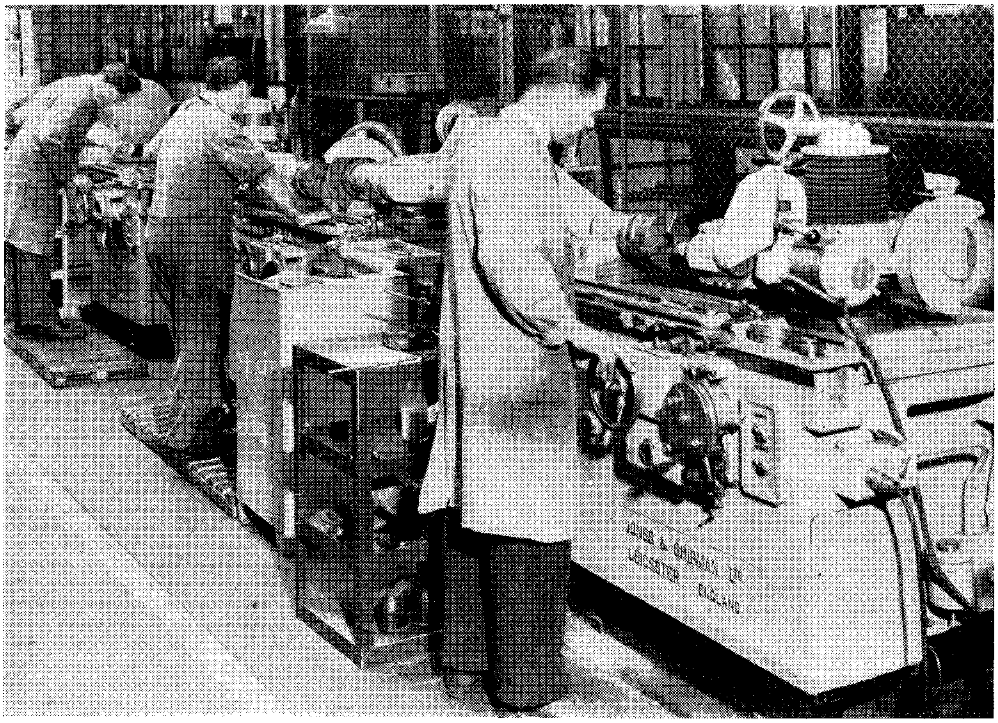
Surface grinding the sides of chuck jaws

Mr. J. R. Tracy, whose united efforts have built up an organisation which, while adhering strictly to the traditions of the original firm, have completely dwarfed it in efficiency and productive capacity.

In 1942, the works was removed to larger premises at Battersea, and then two years later, the firm was forced to move again, when enemy bombing destroyed their works. They took over temporary accommodation at Park Royal, and after the war, another move was made to the present site at Kidbrooke, where they occupy a floor space of 20,000 sq. ft., laid out on the most up-to-date lines, and fully equipped with modern precision machinery. Although the factory has been revolutionised, however, some of the original staff still remain, including Mr. F. G. Cockell, who started at the Putney works when he was 15 years old, and is now in charge of design and development.

The layout of the factory is arranged in such a way that there is a smooth flow of work from the raw material stage to the finished product, and waste of labour eliminated in the handling of the components. All jig and tool work is carried out in the factory, and in view of the fact that many unusual and complicated operations have to be performed at production rates, it has been necessary to devise several special-purpose machines, attachments and fixtures, including devices for cutting scrolls, grinding slideways in jaws, and so on. In many cases the design of these has been the result of years of experience, with no guidance from general engineering practice, and their details are not available for publication.

The possibilities of high-grade material, such as alloy steels, have been exploited to the full in chuck manufacture, with consequent advantage in the strength and durability of the product.



Cylindrical grinding operations on the jaws of assembled chucks

Cast chuck bodies are made in meehanite, suitably heat-treated to ensure stability, and steels having tensile strengths up to 65 tons are used for working parts. As a result, high duty is called for in the production machines and cutting tools, the maintenance of which is a most important factor in ensuring consistent quality of the products.

Chuck bodies and other major components are machined on heavy-duty Ward and Herbert chucking turret lathes, some of which are arranged to perform an automatic cycle of operations. Smaller capstan and turret lathes deal with minor components, and one of the latest additions to the equipment is a Wickham five-spindle automatic lathe for speeding production of these parts. Other special machines include a two-spindle Heald precision boring machine for finishing concentric bores on bodies and scrolls. A line of milling machines is employed for the main machining operations on chuck jaws. Finishing operations on chuck bodies and jaws

are carried out by a battery of Churchill and Jones and Shipman cylindrical and surface grinders, supplemented by specially built machines.

While the plant is arranged for efficient production of a specialised product, it must still be readily adaptable to deal with a wide range of sizes and types, and to cope with varying demands in each case. All parts are finished to very close limits, but it is still necessary to fit each jaw individually to its guide, which calls for highly skilled fitting, and grinding operations on the jaws are carried out while they are assembled in the body, concentricity tests at various diameters being carried out at every stage. It should be noted that any errors in individual components must necessarily affect accuracy, and the most minute errors in the various parts are liable to become cumulative, thereby showing up to conspicuous extent on final test. At least twenty tests are necessary in the final stages of chuck grinding, which is the longest series of operations in the entire manufacture. After final inspection and test, the chucks are dismantled for cleaning and degreasing, when they are again assembled, inspected, oiled and packed for dispatch; but at least 10 per cent. in each batch are given a further final inspection and test as a check on accuracy and quality.

The quality of Burnerd chucks needs no recommendation to model engineers, but it may be of interest to remark that apart from their reputation in this country, they are also held in high esteem in countries long noted for precision machine tools, including both Switzerland and the U.S.A., to which large numbers of chucks are exported. The efficiency and precision of the methods used by Burnerds have been favourably commented upon by expert observers from these countries, and they can more than hold their own in world markets in respect of selling prices, as a result of these methods.

The photographs illustrating the machining operations in the modern factory are reproduced by courtesy of *Machinery*, to whom due acknowledgments are made.

PRACTICAL LETTERS

The Burrell "Lord Fisher"

DEAR SIR,—Whilst reading *The World's Fair* for May 24th, I noticed a paragraph which may be of interest to fellow traction-engine enthusiasts. It concerned the Burrell engine *Lord Fisher*, serial No. 2984 (see "M.E.s," March 17th, April 14th and May 19th, 1949), lately owned by Miss S. Beach, of Southall.

According to the reporter, whose information I acknowledge, it had been on the retired list for some time, but it has now been sold to a traction enthusiast in the Manchester district.

Lord Fisher left Southall for its place of preservation on Sunday May 11th, on a Scammel well-wagon.

The Burrell tractor, *May Queen*, serial No. 3497, still remains at Southall. I believe this engine was renamed from *Conqueror*.

Trusting that this information will prove of interest.

Yours faithfully,
Malmesbury. H. J. OIZOR.

Curved Flywheel Spokes

DEAR SIR,—I am interested in the controversy *re* curved flywheel spokes and I would like to hear the opinion of makers and fitters of such wheels.

I understood the reason for the curved spokes was merely a matter of avoiding the stress in cooling after casting, and that in fitting, it was usual to have the curved spokes in the opposite direction to that shown by Mr. A. W. Pate (May 8th "M.E.") In Mr. Pate's sketch the spokes *look* wrong, somehow.

In 1897 my father purchased a 5 h.p. oil engine, tube ignition, from the makers, Allen & Barkers, Taunton. This engine was fitted with two heavy flywheels with spokes curved in the opposite way to those in Mr. Pate's sketch.

The flywheel on a chaffcutter also had the spokes curved the same way; this suited the cutting blades.

The first motor-tricycle built by Benz, in 1885, had curved spokes on its flywheel, as on above engine and chaffcutter; also, in this district a friend of mine has a pulley wheel on shafting mounted the same way.

I agree with Mr. Pate's theory *re* stress in spokes under condition he mentions, but advance the following:—As a heavy flywheel has a tendency to burst from centrifugal forces, placing the curved spokes as he suggests they would, in overcoming inertia of a heavy rim, tend to help in the bursting of the flywheel. If I have not made myself clear I trust my engineer friends will forgive me; I am a sailing man, not an engineer.

Yours faithfully,
Winscombe. A. STARKEY.
Master Mariner, Ex-C.

Switch Manufacturers

DEAR SIR,—With reference to Query No. 9934 (THE MODEL ENGINEER, No. 2656), Messrs. Lundberg & Sons have been out of business for some time, having been taken over by Simplex Electric of Oldbury, Birmingham.

Yours faithfully,
Bath. J. E. MORRIS.

Model Power Boats

DEAR SIR,—I was very pleased to read the letter from Mr. Liddell in the issue dated May 8th. It does prove that at least one person read the article on *Sparky II*.

As to the fact that *Sparky* does not resemble any existing full-size craft—I am very proud to be able to say that it is an original design.

Mr. Liddell mentions that it grieves him to see the shape things are taking now; well, he wants to go to the Broads and see some of the full-size speed boats running there, I think he would agree *Sparky* does not resemble any of them, but at least it has got quite pleasant flowing lines, and that is more than can be said of a lot of the full-size jobs. Anyway, I think your correspondent has answered his own criticism by saying, that I have produced a mechanism conforming to a given set of rules and having a higher performance than other similarly produced mechanisms.

Now we come to the "trend which may eventually kill this branch of the hobby," I am afraid I just don't get this, as this business of racing small hydroplanes is becoming even more popular; a visit to any regatta run under the M.P.B.A. will soon prove this.

As to making entrants for the speed competition cover a preliminary free run of 60 yd. at 15 knots; first, I know nothing about knots, as this term gave way to miles per hour many years ago in circles where speed has to be measured accurately. Secondly, who is going to stop the boats travelling at this speed? The rules already forbid free-running boats to travel in excess of 12 m.p.h. and it is difficult enough now to find anyone ready to stop them at this speed. Mr. Liddell should come to some of the M.P.B.A. annual general meetings, where somebody is always trying to get the speed limit reduced to 8 or 10 m.p.h. What hopes his 15 knots?

Anyway, the whole idea is just about as sensible as suggesting that free-running boats should be required to do 5 laps at 50 m.p.h. round the pole to prove their speed capabilities before being allowed to run in a steering event. If Mr. Liddell were to extend his activities to car racing, I suppose we should be treated to the sight of super-charged Alfa-Romeos, Ferraris, B.R.M.'s and what have you, doing a five-mile run through London's worst traffic blocks in order to prove something or other before being allowed to race at Silverstone!

What makes Mr. L. think that these small hydroplanes are not flexible? They have to start from a standstill and accelerate up to their maximum speed, and when switched off they have to come all the way down the scale again and float on top of the water until they are retrieved. Or does he imagine that at anything under 40 m.p.h. they sink to the bottom like a stone?

Talking about flexibility, I once went all the way to Paris for the doubtful pleasure of watching *Sparky* cover about six laps at less than walking pace, when it should have been doing 60 m.p.h. *Sparky's* engine can also run in reverse quite well, and that is more than a lot of proper scale model boats can do, so why pick on me?

The calculation that "at speed there is a reduction in displacement of *Sparky* of about 13 oz." leaves me cold. I am sorry to say that even simple calculations are beyond me, and so I have to work by rule of thumb. But I don't need any calculations to tell me that 47 ft. of soaking wet flax line weighs considerably more than 13 ozs.

I can also assure our friend that when one of these speedboats breaks the line and loses its restraining influence, it will invariably carry on planing with the greatest gusto and certainly at no diminished speed, as any one can vouch who has had the melancholy task of dragging up the shattered remains and depositing them on the sturdy concrete bank. (There is always a sturdy concrete bank just here, even if all the rest of the pool has soft mud banks!)

I note that Mr. L. is a lover of steam, but I bet he has never made a racing flash-steamer, or he wouldn't be so fond of it!

I don't know the fuel consumption of *Vesta II*, but perhaps Mr. Jutton could oblige. *Sparky* has covered 25 laps at 55 m.p.h. on approximately 4 oz. of a mixture of Methanol and Nitro-Methane, ignoring the oil content, which I don't think helps the heat energy at all, judging by the amount of liquid oil spattered over the boat.

Of late I have been trying to work out a plan to utilise a free piston engine, but so far have been unable to hit upon a simple and practical idea for starting the thing. Any suggestions will be welcome.

Yours faithfully,

Petts Woods. G. LINES.

Atmospheric Engines

DEAR SIR,—I read with interest about atmospheric and other engines in a recent issue, and now in the May 15th issue I see a reader has mentioned about the Otto & Langen engine. It so happened that I was taking a job for a Mr. Opperman, a gearwheel cutter in Albemarle Street, Clerkenwell, and in the course of talking, he showed me his power unit. That was the first time I ever saw one working. I had a Bischopp and also a ½ h.p. Crossley slide one; cost us 30s. each from a wood yard and we amused ourselves, my brother and I, overhauling them. We used to run them, at times, for an hour or so; of course, gas was then a lot cheaper.

Our regular engine was a 1½ h.p. oil engine, a marine one, and would, on petrol, give 4 h.p.; but we ran it on paraffin. We also had a 6 h.p. National electric light engine that we ran at times when we had a saw job on and a large grindstone. I myself am no lover of high speed, although I was part of my time on aeroplane engines. I should like to see a sketch or drawing of an old atmospheric engine, as well as a plain Newcomen's engine. One could easily be built and without any elaborate finish or show. I myself like to watch a pumping engine at work, and with its various trip valves, when working slow, a person can easily watch its actions like that old steam model in the glass case at the South Kensington Museum; they also have the exact models of our old gas engines on show.

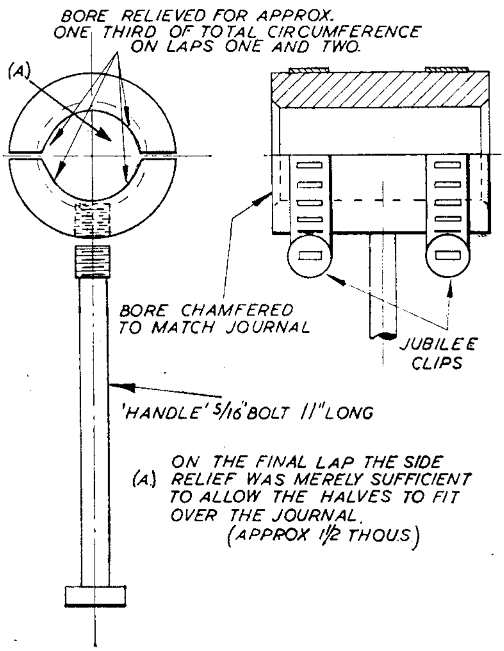
Yours faithfully,

Fulham. D. H. LANGTON.

Truing Up Crankshaft Journal

DEAR SIR,—I was interested in your reply to Query No. 9944, and feel your correspondent may be interested to know that I myself have successfully corrected an oval crankpin on the lines you suggest.

In my case the conditions were, to say the least, rather grim! The car, a Talbot 105, is notorious for its difficult dismantling and with the crankshaft *in situ* working space is limited. The trouble was due to No. 1 big-end "running" 350 miles from home. On the spot repairs being out of the question, the journey home was made on 5 cylinders with the inlet valve push-rod to No. 1 cylinder removed. On removing the sump my worst fears were confirmed, the crankpin having hammered flat to a total of 24-thou., the surface being glass hard.



Details of lap for truing crankshaft journal

The lapping was done with three split laps, turned up from a length of 3 in. diameter cast-iron bar I happened to have in the "scrap-box." The laps were split across the diameter, then clamped together and bored out to progressively smaller sizes, and fitted with a "handle." The two halves were clamped together on the journal by means of two Jubilee worm clips. The first lap was bored 15-thou. undersize relative to the original crankpin diameter and lapping (or grinding!) proceeded, using coarse valve-grinding paste until the Jubilee clips were fully tightened. As the lap could not be rotated 360 deg. due to the close proximity of the webs and cylinder bore, it was reciprocated through an angle of about 45 deg., great care being taken to avoid exerting any lateral pressure. To ensure equal lapping (and to relieve the monotony!) the crankshaft was rotated $\frac{1}{8}$ of a turn for every twenty reciprocations of the lap. This permitted the "handle" to clear all obstructions and remain in the most convenient operating position, i.e. hanging vertically downwards.

The crankpin was now showing signs of becoming circular again, and the second lap, bored 25-thou. undersize, was used, starting with coarse and finishing with fine emery paste. On completion the error was found to be less than 2-thou., which seemed promising. The third lap was now bored out 3-thou. under these dimensions and used with a very fine grade of emery powder and oil, finishing with metal polish. The finished crankpin had an excellent surface and the ovality was less than $\frac{1}{2}$-thou. The big-end was remetalled by Laystalls and carefully hand-fitted. I fitted it on the journal and with the con-rod vertical in the cylinder bore, checked the perpendicular truth by measuring off from the gudgeon-pin boss to each cylinder wall. This was perhaps the most anxious moment, but the error was only $2\frac{1}{2}$-thou. measured at the top of a 10 in. connecting-rod.

This engine has now done 24,000 miles since the repair, mostly at fast touring speeds with up to 4,500 revs. in the gears, and is in every way perfect. So I feel that your correspondent need have no fears about tackling his job.

My final advice is to make everything as comfortable underneath the engine as possible! Clear away any oil drippings and provide an old cushion as a head rest. Cigarettes, matches, and a portable radio alongside help to pass the time! Seriously, my job entailed 40 hours of "lapping," so I estimate he should prepare himself for something like 4-5 hours.

I hope this may be an encouragement to him, as I would add that when I suggested this method to a very well-known firm of motor engineers they politely told me that it would be quite impossible.

Yours faithfully,
London, W.1. J. C. ALDRED.

The 2-mm. Scale Layout

DEAR SIR,—I read with interest your remarks, in the May 1st issue of THE MODEL ENGINEER, on the 2-mm. working layout exhibited at The Model Railway Exhibition, especially your criticism regarding the greens of the meadows, trees, etc.

I agree that your criticism is fair and reasonable. I would, however, like to point out that this layout was made especially for the Model Railway Exhibition, being started in October, 1951. It was only completed at 6 a.m. on Easter Monday, this being achieved only by working 72 hours without a break over the Easter holiday. You will, therefore, appreciate that there was no time to tone down or vary the "greens" if it was to be on show at the exhibition on the following Tuesday.

Due to lack of time, many details had to be skipped over, but now that I have time on my side, I hope to remedy your criticism and others which were brought to my notice by other enthusiasts.

Yours faithfully,
London, W.4. C. D. A. PROVO.
Capt.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed : " Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

In all cases, the fullest possible particulars of the problem should be given, and in the case of electrical queries dealing with windings, etc., all dimensions of rotor or stator slots, or space available on transformer limbs, and cross-section of cores, are essential.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged, depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

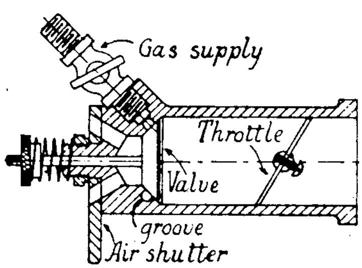
Only one general subject can be dealt with in a single query ; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

Queries involving the valuation of models, or any matters concerned with buying and selling new or second-hand models, cannot be entertained.

No. 9959.—Engine Conversion to Gas
E.A.S. (Reading)

Q.—I have in my possession a Johnson Chore Horse engine which provides the power for my workshop, transmitted through a motor-cycle gearbox to the countershaft. I find this gives me ample power with a speed range of nine open speeds and nine back gear speeds. However, it is inclined to be noisy and I am desirous of changing over to gas with the idea of reducing the noise. Can you please suggest a gas carburettor which I can construct myself, preferably to the design of Mr. Westbury ?

R.—We do not think that changing over from liquid to gas fuel will make any very great improvement in suppressing the noise of your engine, as this will depend more on the exhaust and silencing arrangements, and the mechanical condition of the engine. Exhaust silencing should not be at all difficult if you can provide an expansion chamber of sufficiently large capacity and free from resonance.



A simple gas-mixing device

With regard to your request for particulars of a suitable gas mixer, we give herewith a reproduction of a drawing taken from our handbook *Small Internal Combustion Engines*, which is now out of print. This device was made many years ago, and has proved quite satisfactory in converting petrol engines to run on gas.

No. 9958.—H.P. from a Water Wheel
A.O.S-D. (Romsey)

Q.—I am anxious to ascertain the horse-power I could expect on the belt from an existing water-wheel in an old mill. I can, however, find no formula or information on the subject which would enable me to calculate this. The wheel in question is undershot with straight paddles on an iron framework. The head of water is roughly 5 ft. 6 in. to 6 ft. and the width of the wheel is 3 ft. 6 in. and the overall diameter of the wheel 11 ft. The water supply to the wheel is almost unlimited, winter and summer. Mounted on the water-wheel shaft, which runs in plain bronze bushes, is a large wooden pulley, which, of course, is outside the water area. If I can obtain sufficient h.p. from this wheel, I had thought of running a 250 V, d.c. dynamo, belt-driven and using the output for heating domestic hot water, any surplus being used for space heating.

R.—The horse-power developed by a water-wheel could be calculated fairly simply if the amount of water flowing through the wheel in a given time is known and also the amount of drop. The weight of water is 10 lb. per gallon, and if, for instance, 1,000 gallons of water were flowing through the wheel with a drop of 6 ft., this would amount to $6 \times 1{,}000 = 6{,}000$ ft./lb. per minute, or roughly, 0.181 h.p. This would be the " indicated " h.p., the actual b.h.p. being somewhat less owing to frictional losses. As an alternative to calculation, however, it would be a fairly simple matter to measure the actual b.h.p. at the shaft, by means of a rope brake, using the method which is described in most text-books dealing with principles of mechanics.

No. 9960.—Small Petrol Engine Ignition L.W. (Southall)

Q.—I have made a 5 c.c. "Cadet" petrol engine, but so far have been unable to start it owing to faulty ignition. Could you please put me right on the following :—

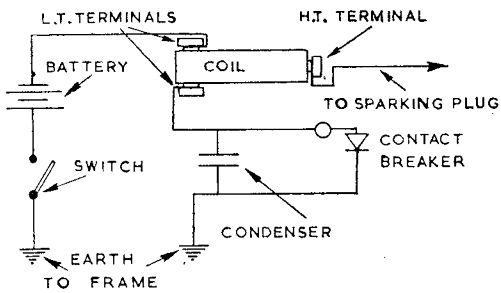
(a) Wiring diagram, incorporating battery, coil, condenser, plug and contact-breaker.

(b) The correct condenser to use.

I should also like to add that I have been confused by the coil, which has only three terminals. I realise that one of these must be common to both primary and secondary windings, but have been unable to ascertain which.

R.—(a) A wiring diagram is given herewith, suitable for any small engine of this type.

(b) The capacity of condenser required is liable to vary somewhat with the type of coil, but as a general rule, it may be stated that a condenser of 0.1 mfd. will give good results.



You are correct in assuming that one of the three terminals of the coil is common to both primary and secondary windings. In many cases it will be found that the battery circuit may be connected either way round to the coil, but in some cases it will be found that the spark is better for one direction of polarity than the other. The third terminal is, of course, connected to the sparking -plug. In the majority of cases there is no difficulty in finding which terminal is supposed to be the H.T. terminal, as this is generally spaced well apart from the primary terminals.

No. 9961.—Machining Cams R.E.B. (Alfreton)

Q.—I am building Mr. Westbury's "1831" 30 c.c. engine and would like a little advice concerning the making of the camshaft. I wish to mill the cams by placing the shaft in the dividing head attached to the vertical slide, together with a master cam twice full size fixed to the blank shaft. Then, with the appropriate milling cutter in the headstock of the lathe, and a follower against the master cam, I hope to generate each cam in turn, move the master cam the required number of degrees, and then repeat the process. Can you please tell me :

(a) Is this method practical ?

(b) What size follower is required in relation to the master cam ?

(c) Can the follower be flat or round ?

(d) Must the milling cutter (end-mill) be the same size as the follower, in the case of a flat follower ?

I have the details of the cam-turning fixture for the "Seal" 15 c.c. engine.

R.—(a) It is quite practicable to mill the cams by the methods described. There is, however, one very grave disadvantage in the application of copying methods for work of this nature. In the first place, it necessitates making a master cam which must be of high accuracy, and in the copying process, it is also possible to introduce errors, though these can be eliminated if every possible precaution is taken.

(b) The enlargement of the follower is only an advantage in minimising errors in one dimension, namely angular measurements. In any method of direct copying, the lift is the same whatever the size of cam, and the only way in which an enlarged follower can minimise these errors is when a pantographic method of copying is employed. Therefore, the advantage of enlarging the follower is not as great as might be supposed.

(c) The follower should always be the same shape as that of the tappet or other type of follower to be used in contact with the cam under working conditions.

(d) This applies also to the milling cutter used to produce the cam, and therefore, an end-mill used with its axis at right-angles to the cam-shaft is correct for cams to be used with a flat follower. It need not, however, be the same size as the follower.

Taking all things into consideration, we should strongly recommend that the method used for producing the cams of the "Seal" 15 c.c. engine would be less troublesome, and, being a direct generating method, is not subject to incidental errors in the same way as copying methods.

No. 9962.—Medical Coil H.H.P. (Banstead)

Q.—I wish to make a small induction coil just for light medical treatment, to work from a battery. Will you kindly inform me how much wire to use for primary and secondary coils, also the gauge for each.

R.—A specification for a coil to work on about 4 V input would be as follows :—

Core, $\frac{5}{16}$ in. dia. × 3 in. long consisting of a bundle of soft iron wires about 20-gauge. Primary, which may be wound directly on the core with the interposition of one or two layers of paper, four layers of 24-gauge enamelled copper wire, approximately 250 to 300 turns. Secondary, may with advantage be made entirely separate on a wood or light plastic bobbin capable of sliding over the primary to adjust the strength of current. It should consist of about 20 layers of No. 36-gauge wire, layer wound with paper interposed between each layer.

The primary coil is connected in series with the contact breaker, and a condenser of 0.5 mfd. is connected across the contact-breaker points. The secondary circuit is entirely separate, and the ends of the winding may be brought out to terminals mounted on the bobbin.

No. 9965.—Setting up a Drummond Lathe and Countershaft
L.F.B. (Oakham)

Q.—May I have your advice on the installation of a lathe. I have acquired a 4 in. × 12 in. round bed Drummond bench lathe. There is no reference number on the plate. It is screw-cutting, but has no back gear, and the mandrel pulleys are in three steps: 6 in., 4½ in. and 3 in. diameter, 1 in. wide for flat belt. The countershaft has a driving pulley equal to, but stepped in the opposite direction to, the lathe pulleys. The driven pulley on the countershaft is 6 in. diameter side by side with a free pulley of the same diameter, also for belt drive. I should be glad of your advice on (1) the best method of setting up the countershaft in relation to the lathe.

(2) What power the motor should be (230-250 V, 50 cycles single-phase supply) and its position.

(3) What size pulley is required for the motor driving shaft, and

(4) Generally on the set up.

R.—(1) The essential thing is that the countershaft should be fitted exactly parallel with the axis of the lathe and that the three stepped pulley should be laterally in line with the corresponding pulley of the lathe headstock. If the lathe is installed with the bed exactly horizontal as proved by a spirit level, and at the same distance each end from the wall, the parallelism of the shafts should be quite easy to check, and the alignment of the pulleys may be tested by placing a straight-edge against the large side of either stepped pulley, bedding it firmly against its side, and ensuring that the other end of the straight-edge comes in line with the second pulley.

(2) For general purposes it will be found that ¼ h.p. motor will give sufficient power for this lathe, but if heavy work is contemplated, a 1/3 h.p. motor would be preferable. The motor pulley should be equal in width to the compound width of the fast and loose pulleys on the countershaft, and should be lined up similarly to the lathe as described above. With a flat belt drive, it is desirable to have a fairly good distance between the shafts, and we suggest that a distance of four feet between the centres in each case will be suitable.

(3) With a standard electric motor running at 1,425 r.p.m. a driving pulley of about 1¾ in. diameter would give a suitable countershaft speed.

(4) The only other point which we consider requires any explanation is the belt-shifting gear, which should consist of a fork wide enough to span the main driving belt, fitted on the entering side of the pulley, that is to say the side that is leading on to the pulley, and some means arranged for sliding the belt from the loose to the fast pulley to engage the drive.

CLUB ANNOUNCEMENTS

The West Riding Small Locomotive Society

An invitation day will be held at Blackgates on Sunday, July 13th. Track reserved for 3½-in. gauge engines (or possibly small 5-in. gauge tank locomotives). Invitation is extended to other clubs or "lone hands." R.S.V.P.

Mr. A. Walker (member), 20, Lady Edith's Avenue, Newby, Scarboro', extends an invitation to any member going to that district for holiday or otherwise, to take a 3½-in. gauge locomotive along with him and run on his continuous track. Every facility available. Telephone: Scalby 402.

Hon. Secretary: DAN HOLLINGS, 8, Limetree Grove, Birkenshaw, Bradford.

York City and District Society of Model Engineers

The next meeting at Railway Street will be held on July 19th, at 7 p.m., Room No. 11.

Locomotive running will take place on the following dates:—

Saturday, July 5th, 3 p.m.; Wednesday, 9th, 7 p.m.
Sunday, 13th, 3 p.m.; Wednesday, 16th, 7 p.m.
Wednesday, 23rd, 7 p.m.

An exhibition is to be held on October 1st to 4th, 1952, in St. Sampson's Church Hall, Church Street, York. Hours of opening: 1st to 3rd, 6 p.m. to 9.30 p.m.; 4th, 10.30 a.m. to 9.30 p.m.

Hon. Secretary: W. SHEARMAN, 28, Terry Street, York.

P.A.D.S.M.E.E.

At the last general meeting, a most instructive talk was given by Dr. Morris on "Ship Models." With the aid of a beautiful model of the 17th century warship, H.M.S. *Prince*, made by himself, and several smaller and marvellously detailed sailing vessels, Dr. Morris described the research and careful study he gives to each subject before he commences modelling; and then went on to give various hints and tips on the several aspects of ship modelling.

The week following, Mr. S. G. Monk gave his postponed and long-awaited talk on I. K. Brunel. After giving a brief history of the life and achievements of this famous engineer, Mr. Monk described in detail the building of that notable landmark, the Royal Albert Bridge. The talk was fully illustrated with the aid of various models and lantern slides, all produced by the lecturer. At the conclusion of this most interesting evening the feeling was expressed that the research and work put into the preparation of the talk was worthy of a far larger audience than that provided by the society only.

Hon. Secretary: J. HAMMOND, Hill House, Hannafore, Looe, Cornwall.

The Oldham Society of Model Engineers

The above society will hold its open day at the Hollinwood Rendezvous on Sunday, July 13th, 1952.

During the afternoon, there will be facilities for operating model cars on a 52½ ft. dia. track, locomotives on 3½-in. gauge track, and model boats on a pond free from weed. Should it not rain before this event, we may be free from water also!

Visitors will be welcome, particularly those with cars, boats, or locomotives, and refreshments will be available. There will be a collection for club funds. The ground is close to the main Oldham-Manchester road behind the Roxy Cinema and reached *via* Hollins Road and Victor Street. Plenty of room for car parking. It's now up to "M.E." readers and the weather clerk.

Club meetings as usual second and fourth Friday in each month, Room No. 1, King Street, Co-operative Society, Oldham, 8 p.m., or any Sunday afternoon at the track.

Hon. Secretary: F. MILLER, 22, Cleeve Road, Oldham.

Bromley Miniature Power Boat Club

An open regatta will be held at Whitehall Recreation Ground, Southlands Road, Bromley, Kent, on Sunday, July 6th, commencing at 1.30 p.m. The events are as follows:

(1) Nomination race for free-running craft.
(2) Radio-control steering competition.
(3) Steering competition for free-running craft.
(4) Relay race for free-running craft.
(5) Radio-control balloon-bursting competition.

Hon. P.R.O.: P. L. PETCH, 200, Langley Way, West Wickham, Kent.